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Prepared for:

*Montana Department of Health
and Environmental Sciences*

by:

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Helena, Montana*

May 11, 1989

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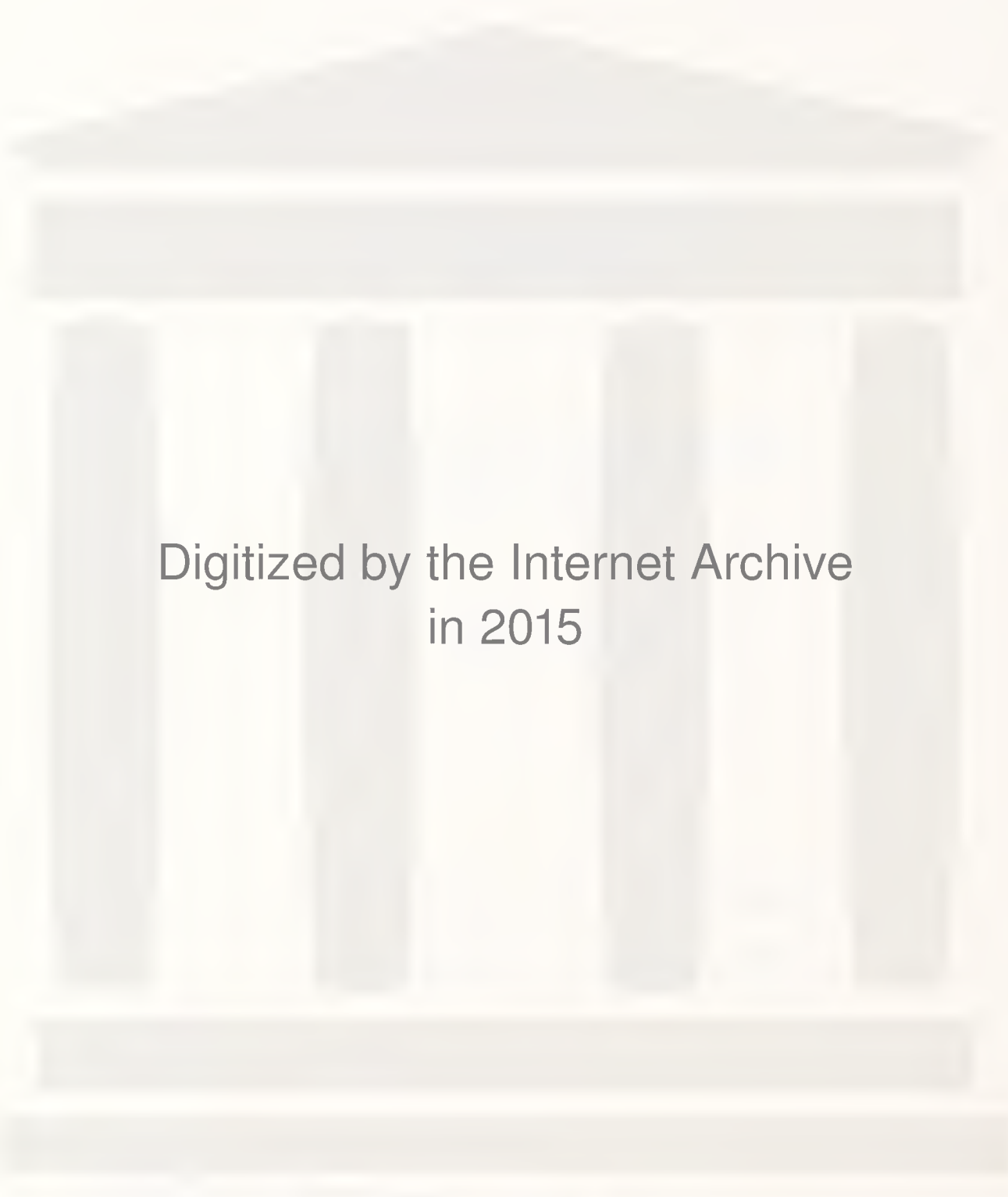
MILLTOWN RESERVOIR SEDIMENTS SITE
MILLTOWN, MONTANA

May 12, 1989

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Milltown Reservoir Sediments Site

Downstream Screening Study

Data Report

APPROVAL FORM

The undersigned have read and approve this Data Report for the Milltown Reservoir Sediments Site, Milltown, Montana.

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SECTION 1.0

1.0 INTRODUCTION

The Milltown Reservoir Sediments Site was placed on the National Priority List in 1982 due to potential risks to human health and the environment. In compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA), a study to identify potential transport of contaminants downstream from the Milltown Reservoir (the Downstream Screening Study) was developed and implemented through a cooperative agreement between the Montana Department of Health and Environmental Sciences (MDHES) and the United States Environmental Protection Agency.

The Downstream Screening Study (DSS) Data Report provides information concerning the occurrence and extent of elevated trace element concentrations downstream from the Milltown Reservoir. The data presented describe trace element concentrations found in surface water, ground water, river sediments and irrigated soils within the designated study area. The data generated by this study, as well as existing data, will aid state and federal agencies in determining the need for additional remedial investigations downstream from the Milltown Reservoir.

1.1 SITE BACKGROUND

The Milltown Reservoir CERCLA site is adjacent to the town of Milltown at the confluence of the Clark Fork and Blackfoot rivers and is located approximately five miles east of Missoula, Montana (Figure 1.1-1). Available historical information indicates the town was founded sometime around 1907-1908 to house employees of the new lumber mill at the site. A dam was constructed in 1906 and 1907 on the Clark Fork River immediately downstream of the confluence with the Blackfoot River to provide hydroelectric power to the mill and the town of Missoula. The area has been an important wood products center since the late 1800s. The Champion

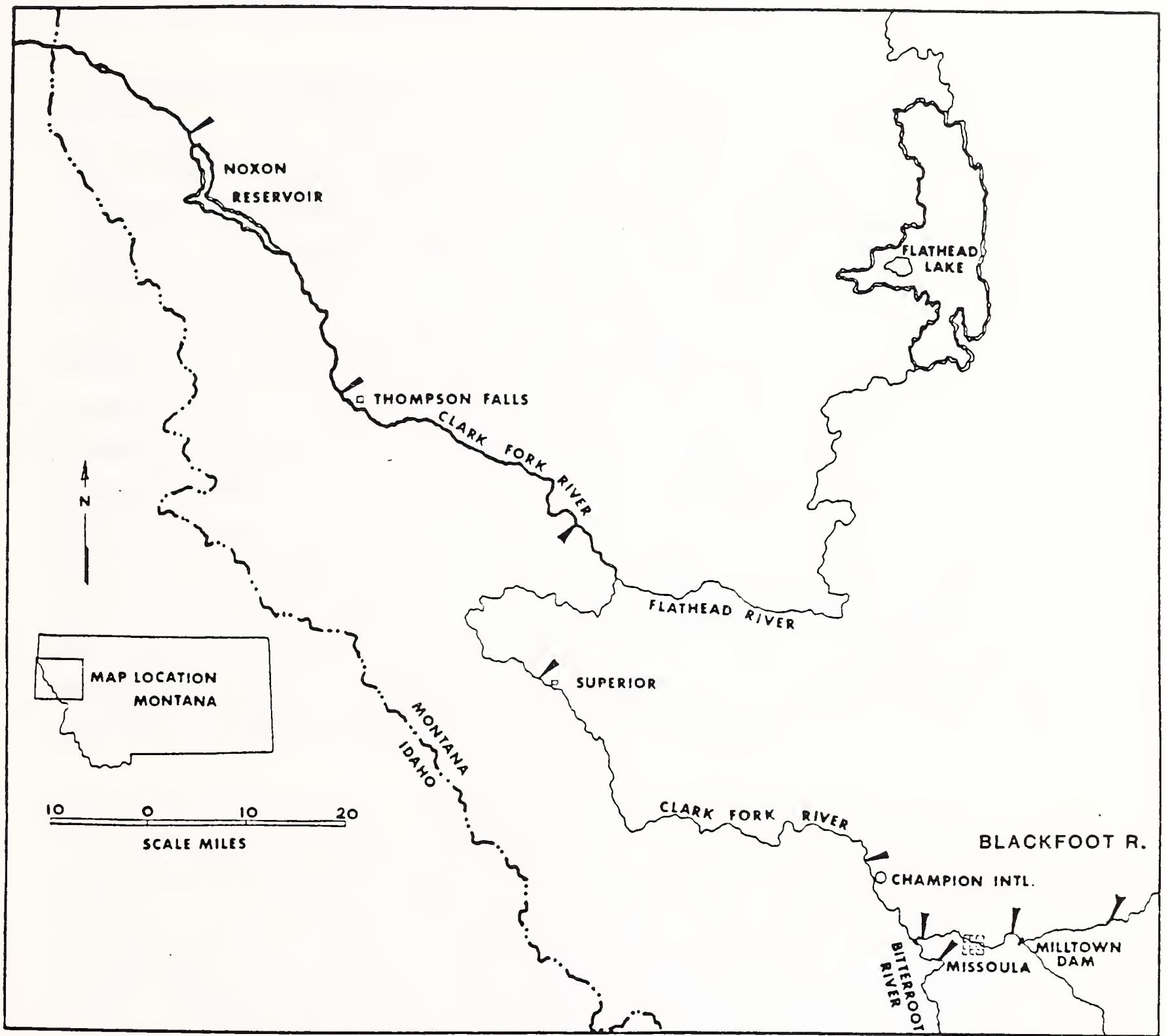


Figure 1.1-1 Site Location Map

International mill currently operates in Milltown and Bonner producing plywood and other wood products.

Since 1908, the reservoir has been subject to considerable sediment accumulation. The Clark Fork River drains an area of approximately 3,710 square miles and has a large capacity for sediment transport. Contaminated sediments in the reservoir originated from historical mining activities located in the headwater region and along tributaries upstream of the dam. Mining and mining-related activities (milling, processing, etc.) in the vicinity of Butte and Anaconda, Montana, along with other downstream regions, contributed to the sediments deposited within the reservoir. The Blackfoot River drains 2,290 square miles, but is characterized by less extensive historical mining activity than the upper Clark Fork drainage. Woessner (1984) has estimated that 29 feet of sediment is present at the upstream face of the dam and that the reservoir contains about 120 million cubic feet of sediment. This sediment has reduced the storage capacity of the reservoir over the years to its present estimated volume of 820 acre-feet at the normal operating level (Curtis, 1984). (Acre-foot is a commonly used unit of volume which corresponds to the volume of water that would cover an area of one acre to a depth of one foot.

The current situation in Milltown is tied to historical events that occurred upstream of the Milltown Reservoir. The Clark Fork River Basin has been the setting for mining activity since 1864. By 1881, Butte was an important mining, milling, and smelting center. At least 25 companies were mining copper ore in Butte by 1885 (Montana Department of State Lands, 1981). Although Butte and Anaconda were the primary mining, milling and smelting centers, other smaller mining districts were active as well. Common mining waste disposal practices up until about 1915 consisted of dumping tailings, milling by-products, and smelting wastes directly into rivers and streams tributary to the mainstem of the Clark Fork. These wastes, containing elevated concentrations of arsenic, lead, cadmium, copper, zinc, iron, and other metals, were added to the normal sediment

load of the Clark Fork, transported downstream, and deposited in the reservoir created by the Milltown Dam.

1.2 SUMMARY OF PREVIOUS INVESTIGATIONS

The contaminants' primary transport mechanisms out of the reservoir consist of entrainment and remobilization of reservoir sediment into the river and dissolution of trace elements into both surface water and ground water. As part of the local aquifer system, elevated concentrations of trace metals have the potential to impact potable water supplies as well as to re-enter surface water downstream along gaining reaches of the Clark Fork.

A reconnaissance-level hydrogeologic investigation was initiated in February 1982 (Woessner and Popoff, 1982) which identified the reservoir sediments as a potential source of arsenic and other metals, including iron, lead, manganese, and zinc. A subsequent investigation began in July 1983 to more thoroughly investigate the ground water contamination problem and to identify an alternative supply for affected Milltown residents. Together these investigations comprise the Remedial Investigation (RI) for the Milltown Reservoir Sediments Site. In 1985 and 1986, supplemental field investigations were undertaken by Harding Lawson and Associates (HLA) under contract to MDHES. The purpose of this investigation was to fill data needs for development, screening, and analysis of alternatives for the Feasibility Study (FS). The scope of HLA's investigation focused on the reservoir sediment, ground water issues, and briefly on surface water quality. The HLA data, although not fully validated and accepted, indicate a potential arsenic plume downstream from the reservoir; however, arsenic concentrations were at or near detection limits (HLA, 1986). Only areas in the immediate vicinity of the reservoir were included in these investigations.

Existing information concerning trace element concentrations in river sediment deposits along the Clark Fork between Milltown Reservoir and the Bitterroot River was derived from studies indirectly related to the

Milltown Reservoir Sediments Site RI/FS. Johns and Moore (1985) sampled bottom sediments in three power generating impoundments along the lower and middle Clark Fork for extractable and total metal content. Results of this study indicated the occurrence of metal enrichment (specifically, zinc and copper) above background levels. Sediment transported from the actively mined headwaters of the Clark Fork was considered to be the probable source of these elements. Upstream of the Milltown Reservoir floodplain sediment, the relationships between metal content and grain size (Moore et al., undated; Brook and Moore, undated) were the focus of several recent investigations. Collection and analysis of fine and coarse grained sediment indicated that typical correlations between decreasing grain size and elevated trace metal content may not be applicable to the Clark Fork River. Because of the unusual availability of metals resulting from mining wastes in the floodplain, all size fractions may equally contribute to contaminant transport in the mainstem of the Clark Fork. However, the effect of the Milltown impoundment and the confluence of the Blackfoot River have yet to be studied in terms of their influence on the transport of metals-laden sediment below the reservoir/dam complex, particularly in regard to the movement of coarser material downstream. Andrews (1987) and Savka (1988) sampled recent channel sediments at various points between Milltown and the Bitterroot River. Savka's sampling did not include the reach of the Clark Fork between Missoula and its confluence with the Bitterroot River.

State and federal agencies (Montana Water Quality Bureau and U.S. Geological Survey) continue to monitor surface water quality at strategic points along the Clark Fork within the study area (Ingman, 1988; Lambing, 1989). To our knowledge, no studies involving contamination of soils by historical irrigation with Clark Fork River water below Milltown Reservoir are currently available for review and inclusion in this document.

1.3 SCREENING STUDY OBJECTIVES

The primary objective of the screening study was to document the occurrence of trace elements in surface water, ground water, river sediments, and irrigated soils influenced by the Clark Fork River downstream of the Milltown Reservoir.

Data quality objectives for this study emphasized collection of data of known quality to determine whether a need exists for additional remedial investigations downstream from the Milltown Reservoir boundaries. Specific objectives of this study included:

- o Determination of trace element concentrations in surface water, ground water, river sediments, and irrigated soils downstream of the Milltown Reservoir.
- o Characterization of the water quality in Champion International's log pond.
- o Investigation of Milltown's community supply wells for the occurrence of organics and trace element contamination.
- o Verification of the existence of an arsenic plume identified by HLA (1986) downstream of the reservoir.

Table 1.3-1 provides a summary of surface water, ground water, river sediment, and soil samples collected during this investigation. Primary sampling locations are illustrated in Plate 1. Criteria for selection of sampling locations are discussed within Section 2.0.

TABLE 1.3-1
SUBTASK ACTIVITY AND SAMPLE SUMMARY

Subtask Activity	Sample Matrix/ Description	Number of Samples ^a
Pre-drawdown Surface Water Sampling	Water/Seven Stations	7
Drawdown Surface Water Sampling	Water/Three Stations	42
Active Channel Sediments	Sediment/Three Stations/ - 1 Opportunistic	7
River Sediments	Sediment/Six Transects	30
Ground Water Sampling	Water/Seventeen Wells - Domestic and Monitoring	17
Irrigated Soils	Soils/Four Soil Types - Treatment and Control	15
		—
Total		118

^a = QA/QC samples not included

SECTION 2.0

2.0 METHODOLOGY

Methodology information is provided in this chapter in five subsections: 2.1 Surface Water; 2.2 Ground Water; 2.3 River Sediments; 2.4 Irrigated Soils; and 2.5 Sample Handling Protocol and Lab Analysis. Each subsection describes sample location strategy, sampling design, and the collection methodology employed. Section 2.5 is dedicated to the procedures used in handling, preserving, transporting, and analyzing samples after collection. Analytes of interest for each matrix and selected analytical techniques are presented.

Implementation of the screening study was accomplished in a phased approach. Task 1 focused primarily on surface water quality in the Clark Fork River and possible changes in the water quality induced by a controlled drawdown of the Milltown Reservoir. Task 2 was more comprehensive, in that ground water, river sediments, soils, and surface water were investigated. In total, one hundred and eighteen samples from eighty-nine locations were collected during the course of the screening study.

2.1 SURFACE WATER

The intent of Task 1 was to provide seasonal (early summer) water quality data for the study reach of the Clark Fork River, as well as to monitor any water quality changes that could result from a 10 foot drawdown of the Milltown Reservoir. The surface water investigation conducted during Task 2 consisted of an inventory of all springs, seeps, and ponds downstream and within a half mile radius of the Milltown Dam. The purpose of this investigation was to sample these surface water features and determine whether their water quality may be influenced by the reservoir (i.e., recharge).

2.1.1 OPERATIONAL DRAWDOWN

On June 27, 1988, the Montana Power Company (MPC) began drawdown of the Milltown Reservoir in preparation of reconstruction of the powerhouse section of the dam. Prior to initiation of drawdown, surface water quality samples were collected from the following locations (Plate 1):

- o USGS Gauging Station at Turah
- o USGS Gauging Station near Bonner on the Blackfoot River
- o USGS Gauging Station at East Missoula
- o Hellgate Canyon
- o University Bridge
- o Reserve Street Bridge
- o Shuffields Property

Sampling locations were chosen to coincide with operational USGS gauging stations and existing MDHES Water Quality Bureau (WQB) stations within the study area. Individual grab samples were obtained at each location by entering the river downstream of the sampling location, wading out as far as possible and collecting a sample upstream at a depth 12" to 18" below the water surface. The short duration of time between contract assignment and initiation of drawdown prevented the collection of more than one series of samples at these locations. Existing data collected by MDHES and the USGS at these locations were obtained for comparison purposes.

During drawdown of the reservoir, surface water samples were collected daily by MPC's consultant at two upstream locations (the USGS stations near Bonner on the Blackfoot River and at Turah on the Clark Fork) and one downstream location (USGS station at East Missoula). Samples were obtained by utilizing USGS equipment and implementing standard U.S. Geological Survey procedures at each station (USGS, 1977). Depth integrated samples were collected at a single vertical profile in a cross-section at the Turah

station, and at four vertical profiles in each cross-section at the Blackfoot station and East Missoula station. Sample splits were obtained by CDM field personnel from the MPC sampling team immediately after collection. Criteria for sample labeling, preservation and transport to the lab are described in Section 2.5. Analytical results from MPC's samples have been acquired for comparison.

In addition to MPC's sampling activities, the USGS conducted two detailed sampling episodes immediately preceding MPC's sampling at the stations described above. Sample results were used to check data collected by the MPC sampling team and, subsequently, to check the Downstream Screening Study data. In total, fifty-five surface water samples were collected between June 26 and July 10, 1988.

Stream-bed grab samples within the vicinity of each USGS cross-section were also obtained by CDM. A total of four samples from each site was secured during and shortly after drawdown. One unscheduled "opportunistic" sample was taken from the East Missoula site. Deposition of a dark, fine grained material over channel deposits prompted this sampling. Samples were collected with a clean plastic scoop. The top 1 to 2 inches of fine grained material deposited at each location was scooped into a quart size Ziplock bag. Each bag was labeled with a unique sample ID number, the time and date, and was double-bagged to protect against breakage.

2.1.2 SURFACE WATER INVENTORY

An inventory of all springs, seeps, and ponds adjacent to and immediately downstream of the Milltown Dam was attempted. Previous dam inspection reports made reference to the existence of several springs and seeps. Aerial photographs and field reconnaissance were used to investigate the target area. However, no springs, seeps, or ponds were observed within the area of interest. Regional drought conditions were evident during the study period. This and a reduction in reservoir head attributable to

drawdown may account for the lack of any surface water features other than the Clark Fork adjacent to the dam.

2.1.3 LOG POND SAMPLING

Surface water samples were also collected from the log irrigation pond ("log pond") at Champion International's mill. The log pond is located south of the Blackfoot River and adjacent to the new Milltown community water supply well. The close proximity of the log pond to the well has prompted concern from state and federal agencies. The purpose of the sampling was to characterize the water in the log pond and determine the presence and concentration of priority organic contaminants. The organic analyses performed were consistent with those performed on the nearby wells. Section 2.5 discusses the analytical suite and methods utilized. The sample results are presented along with the results of the well samples in Section 3.2.4.2 of this report.

The log pond sample was collected using a stainless steel dipper attached to a wooden extension. This sample was collected at a single location from below the surface of the pond. Bottles for the volatile organic analyses were filled immediately from the dipper. Water for the remaining containers was composited in a stainless steel bucket prior to filling them. Samples for metals analyses were preserved with nitric acid. The water for the dissolved metal container was filtered prior to acidification.

All sample collection and handling apparatus was cleaned prior to sampling using the procedures outlined in the Sampling and Analysis Plan (SAP) (CDM, 1988). The sample containers were cooled and prepared for shipment to the Contract Lab Program (CLP). Sample custody was controlled and documented between sample collection and receipt by the laboratory.

2.2 GROUND WATER

2.2.1 WELL INVENTORY

Potential ground water receptors downstream of the reservoir were identified by an inventory of active wells. The well inventory was conducted downstream of the reservoir between Hellgate Canyon and the Milltown Dam. This inventory included the communities of West Riverside, Pine Grove, and East Missoula. Well locations were obtained from the Montana Department of Natural Resources. Water rights applications were searched to develop a list of active wells in the area of interest. Fourteen of the 79 wells identified by the inventory are classified by the MDHES Water Quality Bureau as community or public water supplies.

Known locations of wells identified by previous studies (HLA, 1986; Woessner and Popoff, 1982) immediately downstream of the reservoir were cross checked with well locations identified by the inventory. This ensured a complete record of well locations and likely receptors residing within an area of special interest -- the location of a potential arsenic plume identified by Harding Lawson and Associates (1986).

Inquiries were also made of the Mountain Water Company regarding locations of public supply wells servicing the city of Missoula. Eight high capacity supply wells are located in close proximity to the Clark Fork River in coarse, unconsolidated valley fill. It has been estimated the Clark Fork accounts for roughly ninety percent of the annual recharge to the Missoula aquifer (Woessner, 1988).

2.2.2 SOLE SOURCE AQUIFER APPLICATION REVIEW

The primary objective of this review was to evaluate the potential for contamination posed by sediments from the Milltown Reservoir to the Missoula Valley Aquifer. The Missoula Valley Aquifer receives a significant amount of recharge from the Clark Fork River which could

potentially become contaminated from a release of sediments from the reservoir. The scope of this effort was to review and evaluate data and information in terms of identifying a possible contamination pathway to potential receptors using the Missoula aquifer. Pertinent data and reports included:

1. The Sole Source Aquifer (SSA) Petition by the Missoula City-County Health Department (1988)
2. Clark Fork River Water Quality data from ongoing MDHES monitoring programs
3. Research conducted by students and professors at the University of Montana (Geldon, 1979; Clark, 1986; Woessner, 1988)

2.2.3 WATER LEVEL MEASUREMENTS

Static water level measurements were recorded in a series of wells downgradient of the Milltown Reservoir twice during the study period. Wells were selected to yield a general but accurate indication of ground water gradients throughout the study area. Wells coinciding with four east-west transects were selected to effectively cover the area of interest. Well owners were contacted by phone for permission. If permission was granted, a site visit was scheduled and attended by a licensed surveyor and CDM's field representative. Well locations were noted and measuring points on well casings were surveyed to the nearest hundredth of a foot. If the well had been surveyed during a previous study (HLA, 1986, for instance), no attempt was made to resurvey the well and the existing reference point was used. An attempt was made to measure static water levels during "off" hours when wells were not in use to avoid interferences due to pumping. All measurements were made within a single 24-hour period to ensure measurement of representative aquifer levels. Water levels were measured to the nearest hundredth of a foot with an electronic well sounder and tape. Measurement data were then recorded on field sheets for later use in plotting a ground water contour map.

2.2.4 GROUND WATER SAMPLING

The ground water investigation also consisted of the collection of ground water samples from existing community supply, residential and monitoring wells. Sampling was conducted in October-November, 1988. The program was comprised of two components.

The first component consisted of the collection of samples from ten residential and three monitoring wells in the area of a potential arsenic plume identified by HLA in their investigation of the Milltown Reservoir CERCLA Site (1986). The samples were collected from all known existing wells within the suspected limits of the arsenic plume where access could be obtained. Other wells could exist in the area but are thus far unreported; some wells were not sampled due to lack of permission from the owner. These samples were analyzed for Routine Analytical Service (RAS), dissolved metals and major ions. Other parameters were also measured in the field (see Section 2.5).

The second component consisted of the collection of samples from the Milltown community supply well and two other standby supply wells located nearby. In addition to the parameters identified in the previous section, samples from these wells were also analyzed for CLP routine analytical service organic compounds shown in Section 2.5. Recent concern about leakage of fuels and sludges from local underground storage tanks, and the location of the wells in proximity to the log pond and mill facility, prompted the sampling. Samples for organic analysis were also collected from the log pond (see Section 2.1.3).

Prior to the collection of the ground water samples, each well was purged until the field measurements for temperature, conductivity and pH had stabilized to within ten percent of previous measurements. Most wells were purged such that a minimum of three casing volumes were removed. In several cases the casing volume to be purged could not be determined due to incomplete water level and/or well construction information. In a few

other cases purging was suspended before the target volume was reached due to disruption of service to the owner or excessive bailing time. In these instances sampling was conducted only after the field measurements had clearly stabilized.

Samples were collected from the tap closest to the well and before the water entered any filtration and/or treatment devices. Aerators and/or filters attached to the tap were removed if present. At some locations a polyvinyl chloride hose was attached to the spigot to maintain the cleanliness of the owner's facilities, and the samples were collected at the end of the hose after it had been thoroughly flushed with the sample water.

Containers for the organic constituents and major ions were filled directly. Sample containers for the dissolved metals were filled after passing the water through a 45 micron filtration apparatus using a peristaltic pump. The sample was then preserved with nitric acid after filtration.

After sample collection, final measurements for temperature, pH, conductivity and oxidation/reduction (redox) potential were made, and the containers were stored on ice. All purge data, sampling information and field measurements were recorded in the field notebook. Sample custody was controlled and documented between sample collection and receipt by the laboratory.

Between samples all sampling equipment was thoroughly cleaned or replaced. The decontamination procedure consisted of a detergent solution wash, tap water rinse and final rinse with deionized water. The equipment was also flushed with the sample water prior to sample collection.

2.3 RIVER SEDIMENTS

The river sediment investigation, a component of Task 2, was conducted to study the extent to which metals-laden sediment may have been transported downstream beyond the Milltown Reservoir on the Clark Fork River. Previous studies on the Clark Fork River have shown that contaminated sediments are widely distributed along river sections between Butte and the Milltown Reservoir Site (Moore, 1985; Rice, 1985). However, limited data exist describing distribution of contaminated sediments downstream of the Milltown Reservoir (Andrews, 1987; Savka, 1988).

Sediment sampling was conducted from October 17 to 20, 1988. Annual flow in 1988 at USGS station 123405000, 2.8 miles downstream of the Milltown Dam, was 1544 ft³/sec. This compares to an average annual discharge over the period 1929 to 1987 of 3,020 ft³/sec. This indicates sampling in this study occurred in a low flow year, as well as during the low flow season and thus represents, in part, river sediments deposited under these conditions.

2.3.1 TRANSECT DELINEATION AND SELECTION

Sampling conducted under Task 2 concentrated on areas of fluvial deposition between the Reserve Street Bridge in Missoula and the confluence of the Clark Fork and Bitterroot rivers. Samples were collected along six transects running perpendicular to the course of the river. Transect locations were determined using aerial photography and were finalized in consultation between CDM, MDHES, and University of Montana personnel. Sediment sampling focused on geomorphic features created by fluvial deposition, including high and low floodplains, streambed sediments, and slack water areas. Transects and preliminary sampling sites were marked on overlays to an aerial photograph on April 20, 1987. Final sampling sites were determined after field inspection, and were recorded on the aerial photograph and described in the field notebook. Transects and final sampling locations are shown in Plate 1. The number of samples taken in

each of the physiographic areas -- low floodplain, high floodplain, slack water, and active channel -- over each transect are summarized in Table 2.3-1.

All of the transects, except Transect 1, lie between the Madison Street Bridge and the confluence with the Bitterroot River, the previously mentioned section of the Clark Fork. Transect 1 is located upstream of Bandmann Bridge in East Missoula. It corresponds to a previous sediment sampling location used by Savka as part of a 1986 sediment study (Savka, 1988). In the present Downstream Screening Study, slack water and active channel samples were collected just upstream of the Bandmann Bridge while both low and high floodplain samples were collected approximately 600 yards further upstream on the north bank of the Clark Fork River. Further description and detailed, hand-drawn maps can be found in the field notes.

Transect 2 is located in Missoula proper in the vicinity of the Orange Street Bridge. The low floodplain sample was taken on active channel banks of a small island between a river diversion and the main channel. The high floodplain sample was collected at the end of a street in the vicinity of several houses and may be influenced by construction activities in the area.

At Transect 3, the Clark Fork is split into two channels with the northern channel carrying approximately 90 percent of the total Clark Fork flow. Active channel and slack water were sampled on both the main northern channel and the smaller southern arm of the river. High floodplain samples were to have been taken within 800 feet north of the river. However, as evidenced by the number of meander scars, the river appears to have changed its historical course in this section, extending the lower floodplain approximately three quarters of a mile north of the main channel. As a result, the high floodplain samples were collected just south of Mullen Road.

TABLE 2.3-1
SUMMARY OF PHYSIOGRAPHIC AREAS SAMPLED

Sample Location	Sampling Date	High Floodplain	Low Floodplain	Active Channel Bed	Slack Water	Distance Downstream of Milltown Dam (Miles)
University Bridge	10/17			X ^a		6.1
Reserve St. Bridge	10/17			X		9.4
Transect 1	10/18	X	X	X	X	2.3
Transect 2	10/18	X	X	X	X	7.1
Transect 3	10/18	X	X	XX	XX	11.1
Transect 4	10/19 & 20	XX	X ^b	XX	X	11.6
Transect 5	10/19 & 20	X	XX	XX	XX	12.8
Transect 6 ^c	10/20	X	XX ^b	XX	XX	13.6
		—	—	—	—	
TOTAL NUMBER		7	8	12	9	

^a X equals one sample; XX equals two samples taken from each area.

^b Duplicate taken at this physiographic area and transect.

^c One low floodplain sample substituted for a high floodplain sample.

Transect 4 was started near the Western Wood Products lumber yard on the south and terminated at another bifurcation in the main channel to the north. At this point, river flow in the northern channel was evenly distributed between two secondary channels. Low floodplain samples were taken from the bank of an abandoned channel. The USGS base map does not clearly indicate the location of the river channel between Transect 4 and the confluence with the Bitterroot River. Using aerial photographs, the river course along which sampling occurred was estimated as indicated on Plate 1.

At Transect 5, the Clark Fork consists of two channels of equal flow. Because of the equitable split in flows, active channel bed, slack water, and low floodplain samples were collected from both arms of the river at Transect 5. All samples from the northern arm were located upstream of the diversion dam for French Ditch. Both low floodplain samples were taken from the banks of the active stream channels.

Again at Transect 6, both arms of the Clark Fork were sampled for active channel bed, slack water, and low floodplain sediments. Along the southern arm, active channel bed and slack water sediments were sampled in smaller braids, as opposed to the main channel, that flowed through channel bars. Low floodplain samples represent both active and abandoned channel bank deposits. The high floodplain was originally thought to exist on Kelly Island. Field inspection classified this area as low floodplain; thus, a low floodplain sample was taken to replace a high floodplain sample on Transect 6.

2.3.2 SAMPLING METHODOLOGY

Sediment sampling was conducted to derive the extent and location of contaminated sediment migration downstream of the Milltown Dam. Sediment sampling locations focused on geomorphic features created by fluvial deposition, including the physiographic areas of low (C) and high floodplain (D), active channel bed (A) and slack water (B) sediment

deposits. Sampling locations, labeled according to physiographic area as shown by letter in parentheses, are found in Plate 1. A summary of the number of each type of sample for each transect is found in Table 2.3-1.

2.3.2.1 Description of Physiographic Areas and Sampling Methodology

Active channel bed deposits were located along the edge of the river channels in low velocity zones. In several instances, the river bottom consisted of cobbles and small boulders with interspersed fine grained material. Only the fine grained materials were sampled. Collection of enough fine grained sample in the active channel required sampling along a stretch of river ranging from 50 to 100 feet in length. Slack water sampling occurred in eddies behind channel bars or point bars. Fine grained material proved to be more abundant in slack water areas and so represents sediment collected from one point in the river.

In both active bed and slack water areas, about two pounds of fine grained sediment was collected and placed in a Ziplock bag. Sediment was collected using a plastic scoop. Samples were collected from the top two inches of channel sediment and water was decanted from the sample.

The low floodplain was delineated visually by height and by lateral extent of current and abandoned meanders. Initially, the high floodplain samples were to be collected between the two arms of the Clark Fork River. However, upon field inspection, only the low floodplain was present. At some locations, the high floodplain samples were collected up to three quarters of a mile to the north due to apparent historical changes in stream course. It appears that low floodplain samples represent more recent active channel overflow deposits if taken along the current channel banks. If obtained from abandoned channels, they represent older sediments deposited by historical overbank flows. The high floodplains are alluvial terraces which were formed during times when the river channel was located at a higher elevation than its current channel elevation. The high

floodplain is an 8- to 10-foot-high escarpment present on both the north and south of the lower floodplain.

The low and high floodplain samples were obtained from composite soil profiles at exposed portions of the active river banks, from banks of abandoned channels, or from holes dug into unconsolidated materials of the floodplain. Six inches of exposed bank material was discarded prior to sampling. Samples were collected equally from four points (holes) at each location and from the top 0.5 to 1.5 feet of the soil column. Material from each of the four sample holes was scraped into a plastic mixing bowl using a plastic scoop, mixed thoroughly, and placed in a plastic Ziplock bag and sealed. Samples consisted of nominally two pounds of material. The plastic scoops and bowls were washed withalconox and rinsed thoroughly with tap and distilled water prior to entering the field. A clean scoop and mixing bowl were used at each sampling location.

2.3.2.2 Field Preparation and Analysis of Samples

Field preparation of the sediment samples included air drying and dry sieving through a 10 mesh (2 millimeter) stainless steel sieve. Particles and debris greater than two millimeters were discarded. EC and pH analysis was performed on 100 gram splits of the minus 2.0 millimeter size fraction. To do this, the 100 gram split was thoroughly mixed with 100 milliliters of deionized water for 1 to 3 minutes, allowed to settle, and the supernatant liquid was analyzed for pH and EC. EC and pH meters were calibrated on a daily basis, at a minimum. The remaining material less than 2 millimeters was then dry sieved through a 63 micron stainless steel sieve. Two size fractions, a <63 micron fraction and a >63 microns but <2 millimeters, were sent to the laboratory for total metals analysis. Analytical parameters for sediment and analysis methodology are presented in Section 2.5.

2.4 IRRIGATED SOILS

The objective of the irrigated soils program was to determine if past irrigation activities, using potentially contaminated water from the Clark Fork River, had affected agricultural soils. The program consisted of 15 sample pairs (30 total samples). Each pair was collected from the same soil type. One sample was collected from soils irrigated by water from the Clark Fork River. The corresponding control sample was collected from unirrigated soil or soils irrigated with water from another source. Three sample pairs were collected from each soil type. Sampling was conducted at two general locations, both shown on Plate 1. Eighteen samples were collected from three different soil types near Bandmann Flats, approximately 1 to 2 miles below the dam. At the second location in the Grant Creek area (8 to 10 miles below the Milltown Dam site), twelve samples were collected from two soil types.

Irrigation practices were determined from available information contained in the Montana Water Resources Survey and Montana Department of Natural Resources and Conservation (MDNRC, 1960), as well as review of aerial photographs, field reconnaissance and land owner interviews. The soil type was determined for each sampling site using published mapping on an aerial photograph base included in the Draft Missoula County Soil Survey (SCS, 1988), and was supplemented by field reconnaissance. During the land owner interviews it was discovered that many of the fields in the Grant Creek and Bandmann Flats area have received applications of municipal sewage sludge (Pruyn, 1988) as a soil amendment. Sampling was not conducted in areas suspected to have received these applications.

Each sample was comprised of material composited from the upper $\pm$ 6 inches from each corner of a ten-foot square superimposed on the sample site. The material was collected using a plastic scoop, placed in a plastic bowl and then homogenized. Approximately two pounds of soil were placed in a Ziplock plastic bag, labeled and sealed. Excess material was then discarded. All sample collection data, agricultural practices, and a

description of the soil were recorded in the field notebook. Sampling utensils were cleaned between each use by washing in a detergent solution, rinsing in tap water and then deionized water.

After completion of the field sampling program the soil samples were prepared for analysis. The preparation consisted of the same procedure outlined for the sediments (Section 2.3.2.2).

2.5 SAMPLE HANDLING PROTOCOL AND LAB ANALYSIS

2.5.1 SAMPLE HANDLING

Sample custody and handling implemented during this project are described in detail in the Sampling and Analysis Plan (CDM, 1988). All samples remained in the custody of CDM field personnel until shipment to the laboratory. Dates of sample collection, sample ID numbers, custody personnel, shipment number, and time and date received by the lab were transcribed on the Chain of Custody forms for each sample. All sample containers were transported by Federal Express directly to the designated laboratories assigned by EPA's Sample Management Office.

Samples were collected, stored and transported in nonreactive receptacles. Soil/sediment samples were collected with clean, hard polyethylene scoops and transported in Ziplock bags to the field lab for drying, analysis of field parameters, sieving and placement in glass containers (8 oz. IChem jars) with non-metallic screw caps for shipment to the CLP laboratory. Inorganic surface water samples were collected with a USGS acrylic coated, depth integrated sampler ("fish"), transferred into a polyethylene water churn for sample splitting, spigotted into 1 liter polyethylene bottles with polycaps and preserved if required. Inorganic ground water samples were obtained directly from the water system or with a stainless steel or PVC bailer, transferred directly or filtered into containers similar to surface water samples, and preserved (if required) for shipment. Organic ground water samples were collected directly from each water system prior

to any in-line filtration or treatment. Volatile organic ground water samples were placed in 40 ml vials and capped with no air space remaining in the vial. Extractable organic samples were secured in 80 oz. amber bottles for storage and shipment. Organic samples from the log pond were also collected and handled in a manner consistent with these procedures.

Prior to shipment, all samples were individually sealed in Ziplock bags, placed in shipping containers packed with vermiculite to prevent breakage, and iced if needed. Shipping containers were sealed in accordance with methods outlined in the SAP (CDM, 1988) and shipped directly to the assigned laboratory for analysis.

2.5.2 SAMPLE ANALYSIS

Laboratory chemical analysis of aqueous and solid matrix samples was conducted through EPA's Contract Laboratory Program, in accordance with protocol specified in the Quality Assurance Project Plan (QAPP) and the Sampling and Analysis Plan. The purpose of the Contract Lab Program is to provide analytical data of consistent and known quality. EPA CLP methods for analyses are rigorous and provide standardized limits of detection and quality control which help ensure reproducible and legally defensible data.

All inorganic samples were analyzed in accordance with analytical requirements of CLP Statement of Work 785 and QA/QC requirements detailed in the QAPP. Organic samples (Table 2.5-1) were analyzed in accordance with CLP Statement of Work 10/86. Descriptions of inorganic analytes of interest are listed in Table 2.5-2 for the solid matrix (soils and sediments) and Table 2.5-3 for the aqueous matrix (ground waters and surface waters).

TABLE 2.5-1

GROUND WATER ORGANIC ANALYTES^a

Volatile Compounds	Semi-Volatile Compounds	Pesticides/PCBs
Chloromethane	Phenol	Alpha - BHC
Bromomethane	bis(-2-Chloroethyl)Ether	Beta - BHC
Vinyl Chloride	2-Chlorophenol	Delta - BHC
Chloroethane	1,3-Dichlorobenzene	Gamma - BHC (Lindane)
Methylene Chloride	1,4-Dichlorobenzene	Heptachlor
Acetone	Benzyl Alcohol	Aldrin
Carbon Disulfide	1,2-Dichlorobenzene	Heptachlor Epoxide
1,1-Dichloroethene	2-Methylphenol	Endosulfan I
1,1-Dichloroethane	bis(2-Chloroisopropyl)Ether	Diieldrin
Trans-1,2-Dichloroethene	4-Methylphenol	4,4' - DDE
Chloroform	N-Nitroso-Di-n-Propylamine	Endosulfan Sulfate
1,2-Dichloroethane	Hexachloroethane	4,4' - DDT
2-Butanone	Nitrobenzene	Methoxychlor
1,1,1-Trichloroethane	Isophorone	Endrin Ketone
Carbon Tetrachloride	2-Nitrophenol	Chlordane
Vinyl Acetate	2,4-Dimethylphenol	Toxaphene
Bromodichloromethane	Benzonic Acid	Aroclor - 1016
1,2-Dichloropropane	bis(2-Chloroethoxy)Methane	Aroclor - 1221
Trans-1,3-Dichloropropene	2,4-Dichlorophenol	Aroclor - 1232
Trichloroethene	1,2,4-Trichlorobenzene	Aroclor - 1242
Dibromochloromethane	Naphthalene	Aroclor - 1248
1,1,2-Trichloroethane	4-Chloroaniline	Aroclor - 1254
Benzene	Hexachlorobutadiene	Aroclor - 1260
cis-1,3-Dichloropropene	4-Chloro-3-Methylphenol	
2-Chloroethylvinylether	2-Methylnaphthalene	
Bromoform	Hexachlorocyclopentadiene	
4-Menthyl-2-Pentanone	2,4,6-Trichlorophenol	
2-Hexanone	2,4,5-Trichlorophenol	
Tetrachloroethene	2-Chloronaphthalene	
1,1,2,2-Tetrachloroethane	2-Nitroaniline	
Toluene	Dimethyl Phthalate	
Chlorobenzene	Acenaphthylene	
Ethylbenzene	3-Nitroaniline	
Styrene		
Total Xylenes		

^a Standardized organic analytical methods are based on Federal Register Methods 625 (B/N/A), 608 (pesticide), and 624 (VOA) modified for CLP use.

TABLE 2.5-2
SOIL AND SEDIMENT ANALYTES^a

Total Metals	Other Analytes
Aluminum	pH (Field)
Antimony	EC
Arsenic	
Barium	
Beryllium	
Cadmium	
Calcium	
Chromium (Total)	
Cobalt	
Copper	
Iron	
Lead	
Magnesium	
Manganese	
Mercury	
Nickel	
Potassium	
Selenium	
Silver	
Sodium	
Thallium	
Vanadium	
Zinc	

^a Standardized inorganic analytical methods are based on EPA Test Methods for Evaluating Solid Waste (SW-846) 1980.

TABLE 2.5-3
SURFACE AND GROUND WATER INORGANIC ANALYTES^a

Total, Total Recoverable, and Dissolved Metals ^b	Major Ions	Other Analytes
Aluminum	Carbonate/	Acidity/Alkalinity
Antimony	Bicarbonate	Temperature (Field)
Arsenic	Chloride	pH (Lab and Field)
Barium	Sulfate	Specific Conductance
Beryllium		(Lab and Field)
Cadmium		Oxidation-Reduction
Chromium (total)		Potential (Field)
Cobalt		
Copper		
Iron		
Lead		
Magnesium		
Manganese		
Mercury		
Nickel		
Potassium		
Selenium		
Silver		
Sodium		
Thallium		
Vanadium		
Zinc		

^a Standardized inorganic analytical methods are based on EPA Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020, Revised March 1986).

^b Dissolved metals determinations only were made on the ground water samples.

SECTION 3.0

3.0 RESULTS AND DISCUSSION

This chapter presents the results of the screening study. Data reduction, statistical evaluations, and corresponding trends and inferences are discussed individually as they pertain to the objectives of each subtask. Where appropriate, tables and graphs have been added to clarify text and highlight important points. Statistical evaluations were conducted using SYSTAT Inc. (1987), a microcomputer statistical package. Sampling locations have been plotted on maps to help orient the reader.

Data quality assurance and quality control are addressed in Appendix 5.1. Explanations regarding the precision and accuracy of the data and any bias introduced by field or lab methods are discussed. Appendix 5.2 presents all field and laboratory analytical results for each set of data, including qualifiers. Data validation comments are included in Appendix 5.3.

The primary inorganic analytes of concern during this study were arsenic, cadmium, copper, lead, manganese, and zinc. Their potential occurrence in elevated concentrations downstream of the reservoir prompted federal and state officials to initiate this study.

3.1 SURFACE WATER

3.1.1 PRE-DRAWDOWN SAMPLING

Surface water samples were collected prior to initiation of the controlled drawdown of the Milltown Reservoir. The intent of this sampling was to obtain seasonal (early summer) water quality data throughout the study reach prior to drawdown, compare it to existing water quality data, note obvious differences, and monitor any changes that might occur as a result of the drawdown. Timing constraints restricted pre-drawdown sampling to one episode. Water quality samples were collected at six stations along the mainstem of the Clark Fork River and one on the tributary Blackfoot

River. Two stations were upstream of the reservoir and represented inflow values. The remaining five extended from the Bandmann Bridge above East Missoula to about two miles below the outfall of the Missoula Wastewater Treatment Facility (Plate 1). The MDHES Water Quality Bureau has compiled a data base for these locations from previous investigations and current sampling programs (MDHES, 1985). A summary of their data and the results of pre-drawdown values obtained during this study is presented in Table 3.1-1. The Water Quality Bureau data did not include lead; therefore, this element is not shown on the Table.

Typical trace element concentrations for the mainstem of the Clark Fork within the study reach are below EPA's Drinking Water Maximum Contaminant Levels (MCLs). Background data indicate a wide range of concentrations is common along the mainstem of this river. Existing trace element data (MDHES, 1985) generally exceeded data element values recorded during this pre-drawdown survey. No relationship is apparent between concentration and distance downstream from the reservoir. Historical information and data collected during this study do indicate lower trace element concentrations in the Blackfoot River as opposed to stations on the Clark Fork River.

3.1.2 DRAWDOWN SAMPLING

Three stations were sampled daily during the 14 day drawdown period, two above the reservoir (Blackfoot River, Clark Fork at Turah) and one below (East Missoula). Bracketing the reservoir allowed both inflows and outflows to be sampled, resulting in a more complete monitoring. Results of the sampling are summarized in Table 3.1-2. These analytical methods were implemented to detect trace elements in aqueous samples. They consisted of total, dissolved, and total recoverable metals analyses. "Total" metals analysis refers to a complete or hard digestion of an unfiltered sample. In contrast, "dissolved" metals refers to analysis of that portion of the sample passing through a 45 micron filter. This analysis is designed to detect metals already in solution. The "total

TABLE 3.1-1

PREVIOUS AND PRE-DRAWDOWN SURFACE WATER QUALITY RESULTS^a

Analytes (µg/l)	Clark Fork at Turah Station	Blackfoot River Station	East Missoula Station	Hellgate Canyon Station	Reserve St.		Shuffields Station	MCL ^e	Aquatic Life Water Quality Criteria		Gold Book Human Health
					Bridge Station	Station			Acute ^f	Chronic ^g	
Arsenic	7.6 ^b (45) ^c	<3.9 (1.0) ^d	<3.9 (5.0)	<3.9 (4.0)	<3.9 (5.0)	<3.9 (5.0)	<3.9 (5.0)	50 ^a	360	190	.0022
Cadmium	<4.2 (<5.0)	<4.2 (<5.0)	<4.2 (<5.0)	<4.2 (<5.0)	<4.2 (<5.0)	<4.2 (<5.0)	<4.2 (<5.0)	10 ^a	6.4	1.6	10
Copper	<17.0 (20.0)	<17.0 (10.0)	<17.0 (20.0)	<17.0 (10.0)	<17.0 (20.0)	<17.0 (20.0)	<17.0 (20.0)	1,000 ^b	27	17	1,000 ⁶
Manganese	15.7 (10.1)	9.3 (16.0)	25.8 (76.0)	27.4 (32.0)	25.6 (65.0)	20.4 (65.0)	20.4 (65.0)	50 ^b	-	-	50
Zinc	<11.0 (39.0)	<11.0 (7.0)	<11.0 (29.0)	<11.0 (22.0)	<11.0 (38.0)	<11.0 (27.0)	<11.0 (27.0)	5,000 ^b	170	154	5,000

^a All values reflect the arithmetic mean of Total Recoverable Analyses: Total number of samples varies

^b Pre-Drawdown concentrations obtained during this study

^c Values in parentheses are summarized results from MDHES Water Quality Bureau's Champion
EIS data base (1984-85)

^d < sign denotes below detection limit

^e Safe Drinking Water Act; 40 CFR Part 141, Subpart B

^f 1-hour acute; hardness - 155 mg/L

^g 4-day chronic; hardness - 155 mg/L

TABLE 3.1-2

DRAWDOWN SURFACE WATER DATA SUMMARY
(All Values are in $\mu\text{g/L}$)

	Clark Fork at Turah			Blackfoot at Bonner			Clark Fork at E. Missoula			Aquatic Life Water Quality Criteria		
	Range	Mean	Range	Range	Mean	Range	Range	Mean	MCL ¹	Acute ²	Chronic ³	Gold Book Human Health
Arsenic ($\mu\text{g/L}$)												
Total	4.6 -	7.2	5.77	<2.0 -	5.7	<2.0	6.6	4.08	50 ^a	360	190	0.0022
Dissolved	4.4 -	6.9	5.48	<2.0		<2.0	4.0	3.28				
Total Recoverable	3.9 -	9.3	5.82	3.9 -	8.1	<2.0	8.3	4.74				
Cadmium												
Total	<5.0		<5.0	<5.0		<5.0		<5.0	10 ^a	6.4	1.6	10
Dissolved	<5.0		<5.0	<5.0		<5.0		<5.0				
Total Recoverable	3.7 -	5.0	3.98	3.7 -	5.0	3.98	5.1	4.05				
Copper												
Total	<6.0 -	25.4	12.24	<6.0 -	31.5	8.9	57.1	19.8	1,000 ^b	27	17	1,000 ⁶
Dissolved	<6.0 -	18.3	7.23	<6.0 -	17.3	6.3	24.4	6.4				
Total Recoverable	17.0 -	22.0	20.00	17.0 -	128.0	19.4	54.6	21.6				
Manganese												
Total	17.7 -	43.4	24.9	9.1 -	27.9	12.3	150.0	71.3	50 ^b	-	-	50
Dissolved	<7.0 -	10.9	8.6	<7.0 -	7.3	<7.0	75.9	43.7				
Total Recoverable	6.6 -	35.4	17.9	6.1 -	144.0	17.96	150.0	65.8				
Lead												
Total	<2.0 -	13.3	3.7	<2.0 -	16.8	5.1	10.9	5.2	50 ^a	142	5.6	50
Dissolved	<2.0 -	10.3	4.5	<2.0 -	13.0	4.2	6.7	2.9				
Total Recoverable	0.9 -	1.9	1.2	0.9 -	21.6	2.9	7.1	2.7				
Zinc												
Total	5.0 -	26.1	17.7	3.9 -	336.0	13.7	289.0	41.3	5,000 ^b	170	154	5,000
Dissolved	7.3 -	24.4	14.3	3.8 -	181.0	10.1	82.8	11.6				
Total Recoverable	11.0 -	77.5	20.5	11.0 -	106.0	12.3	102.0	27.1				
Total Suspended Solids (mg/L)	3.0 -	11.0	5.5	2.6 -	10.7	3.9	64.7	21.4				
Flow** (cfs)	706 -	950	827	733 -	1,040	891	2,000	1,713				
n (sample size)	15			15			15					

* < Indicates value below detection limit.

** Based on USGS data for water year 1987-88 (6/26/88-7/10/88).

ND Not detected.

^a Primary MCLs.^b Secondary MCLs.

1 Safe Drinking Water Act; 40 CFR Part 141, Subpart B.

2 1-hour acute, hardness - 155 mg/L.

3 4-day chronic; hardness - 155 mg/L.

4 - Water Act; 40 CFR Part 131.

recoverable" metals analysis is a "soft digestion" which detects metals easily liberated from suspended solids into solution.

Dissolved metals produced the greatest number of values below detection limits, followed by total recoverable metals, and total metals. With the exception of several outliers (extreme observations), the Blackfoot Station generally had lower trace metal averages than the other stations. Outliers for each station were omitted from statistical descriptions and analyses to prevent distortion of valid observations. Cadmium was the only trace metal consistently below detection limits at all three stations. East Missoula was generally higher than the Turah Station in average total and total recoverable copper, manganese, lead, and zinc. Turah produced higher average arsenic values and dissolved copper, lead, and zinc.

In general, all trace element concentrations were below Safe Drinking Water Act primary and secondary MCLs except manganese at the East Missoula station. Manganese exceeded the secondary MCL for both total metals and total recoverable metals. Chronic aquatic life water quality criteria were exceeded at all stations for average total recoverable cadmium and copper, and average total copper at the East Missoula Station.

The most pronounced difference between stations was in total suspended sediment (TSS). Values ranged from a high of 64.7 mg/l to a low of 0.5 mg/l, both occurring at East Missoula as a result of retention of sediments in the reservoir and subsequent release during drawdown. Since drawdown occurred after spring runoff, it was anticipated that only minor increases in TSS would occur during drawdown. TSS values remained below values associated with high runoff conditions.

Suspended sediment values can be used as an indication of the reservoir's ability to retain fine sediment under certain flow conditions. However, suspended sediment comprises only one portion of a complete sediment budget. A sediment budget based on data collected during this study for the reservoir is presented in Table 3.1-3. The control portion of the

TABLE 3.1-3

ESTIMATED SUSPENDED SEDIMENT BUDGET FOR MILLTOWN RESERVOIR

Control: Suspended Sediment Prior to Drawdown
 Period: 6/20/88 - 6/26/88 (USGS, 1988)

	Clark Fork at Turah	Blackfoot River	Clark Fork at E. Missoula
Discharge (cfs)	932	1,103	1,996
TSS (mg/L)	15.4	6.4	8.0
Suspended Sediment Discharge (tons/day)	39 ✓	19	43 ✓
Reservoir Inflow (tons/day): Turah + Blackfoot	58		
Reservoir Outflow (tons/day):	43		
Net Storage (tons/day):	+15		

Drawdown: Average Suspended Sediment Load During Drawdown
 Period: 6/26/88 - 7/10/88 (CDM, 1988)

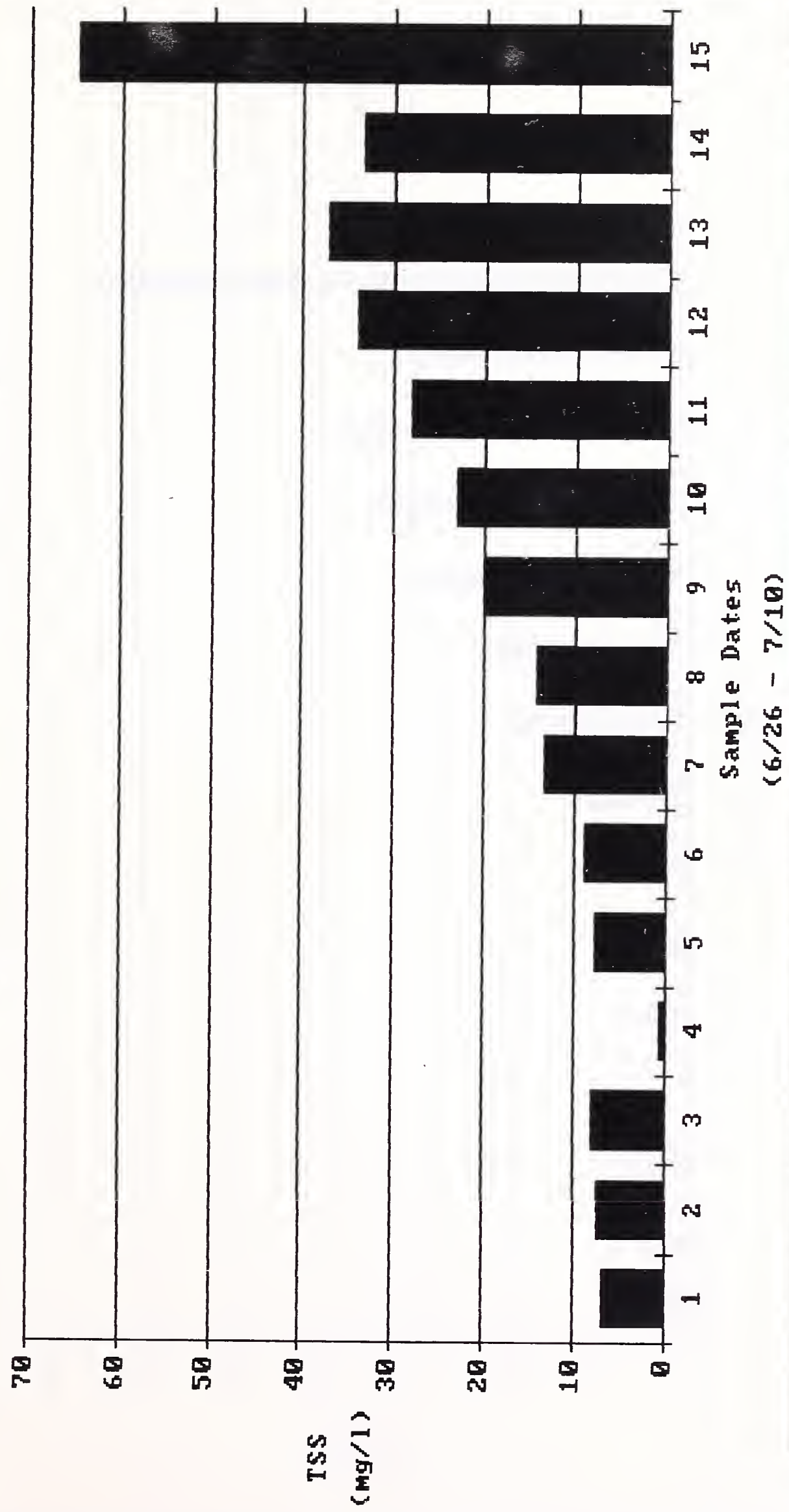
	Clark Fork at Turah	Blackfoot River	Clark Fork at E. Missoula
Ave Discharge (cfs)	827	891	1,713
TSS (mg/L)	5.5	3.9	21.4
Suspended Sediment Discharge (tons/day)	12.3	9.4	99
Reservoir Inflow (tons/day):	21.7		
Reservoir Outflow (tons/day):	99		
Net Storage (tons/day):	-77.3		

Based on Average Daily Values for flow and TSS

table consists of average daily discharge and TSS values collected by the U.S. Geological Survey for a six day period prior to initiation of drawdown. The data indicate that prior to drawdown, the reservoir was storing sediment at an approximate rate of 15 tons per day with the Clark Fork contributing approximately 67 percent of the sediment load. The second half of the table illustrates the potential for change in the storage balance within the reservoir. Over the course of 14 days and a pool reduction of 10 feet, a net loss of approximately 77 tons per day was estimated based on suspended sediment recorded by this study. This change in sediment storage was verified by USGS daily sampling data collected during the same time period (USGS data water year 1987-1988).

Figure 3.1-1 illustrates suspended sediment concentrations collected during the drawdown interval at the East Missoula Station. It is apparent from this graph that suspended sediment steadily increased throughout the drawdown period. Total arsenic, copper, manganese, and zinc concentrations also showed a steady increase at the East Missoula Station. Lead, however, demonstrated a bimodal increase that did not appear to follow the progress of pool level reduction. Similar trends in trace element and suspended sediment results were not apparent at the Turah and Bonner stations during this period. Figure 3.1-2, TSS concentrations at East Missoula with Turah and Bonner stations, illustrates this point. This difference seems to indicate that the increase of trace metal noted at the East Missoula Station was not solely attributable to sediment and trace element inflows into the reservoir. To evaluate and clarify this observation, the means for total metal concentrations for each station were statistically compared to determine the significance of observed differences between upstream and downstream stations. The data were normalized using a log transformation and T-Tests were used to determine the significance of any population differences based on sample means. The "students t-distribution" was developed for problems involving the sample mean when the sample variance is unknown and the sample size is small ($N < 30$). It is a commonly used parametric method for determining significant differences between sample means. The results of these tests are presented in Table 3.1-4. Cadmium

Figure 3.1-1
East Missoula Station - Total Suspended Sediment



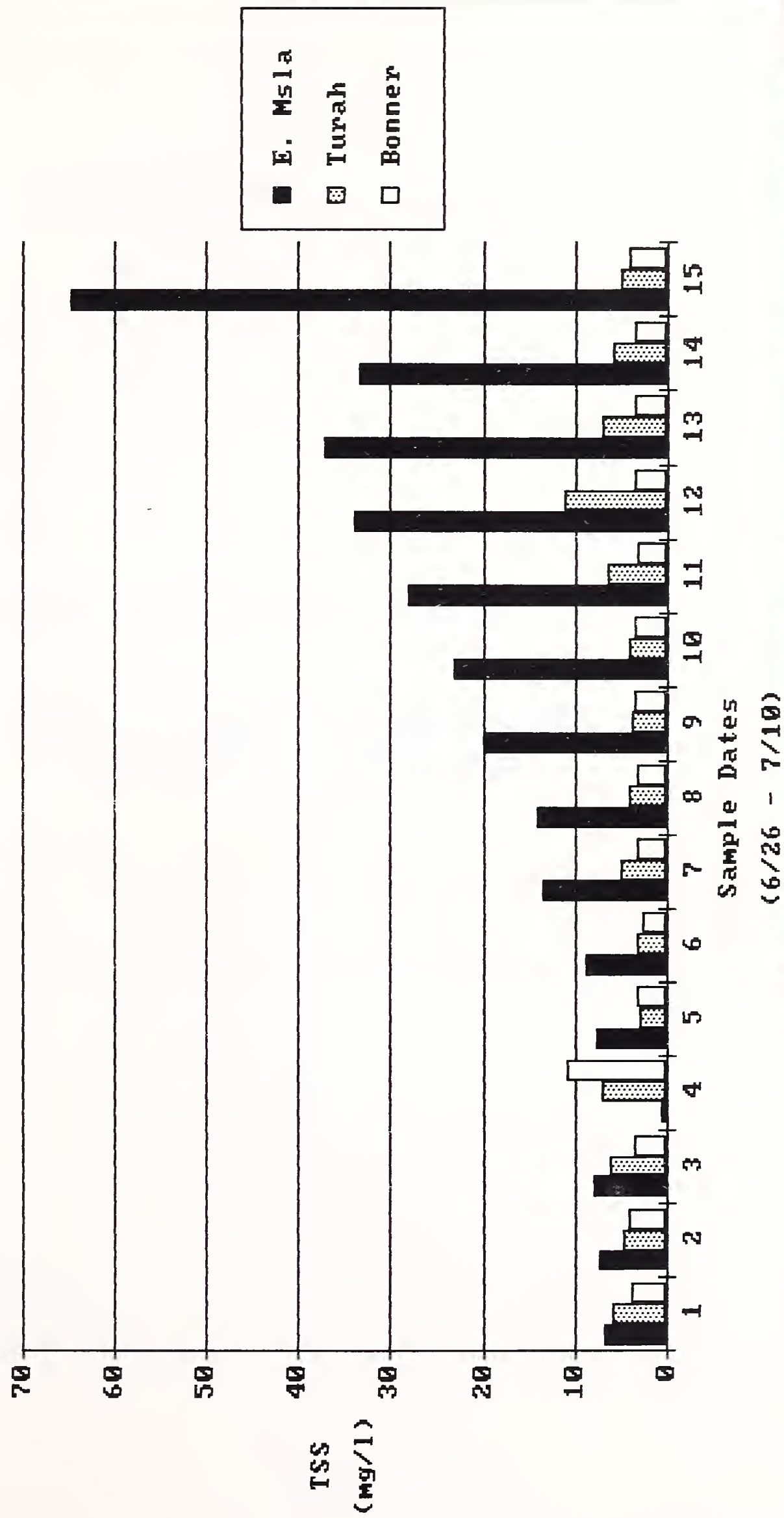


Figure 3.1-2
E. Missoula vs. Turah and Bonner Suspended Sediment

TABLE 3.1-4

RESULTS OF T-TESTS FOR DIFFERENCES BETWEEN
EAST MISSOULA AND TURAH STATIONS^a

	As	Cu	Mn	Pb	Zn
Probability $\geq$ 95%	*	*	*	NS	*
Probability $\geq$ 99%	*	NS	*	NS	*

RESULTS OF T-TESTS FOR DIFFERENCES BETWEEN
EAST MISSOULA AND BONNER STATIONS^a

	As	Cu	Mn	Pb	Zn
Probability $\geq$ 95%	*	*	*	NS	*
Probability $\geq$ 99%	*	NS	*	NS	*

* = Significant

NS = Non-significant

^aN = 15 samples/analyte

was not tested because of a frequent number of values below detection limits. This table demonstrates a significant difference at the 95 percent level between Turah and East Missoula, and Bonner and East Missoula for all trace metals except lead. This difference was successfully demonstrated for arsenic, manganese, and zinc at the 99 percent level.

These test results, in addition to the reservoir sediment storage flux described earlier, infer that the increase at the East Missoula station was attributable to the Milltown Reservoir sediments. The relationships between increasing suspended sediment loads and increasing trace element concentrations was tested using a simple linear regression model. The purpose of regression is to establish a functional relationship of one variable with one or more other variables. The results of the regression model and Pearson correlations are presented in Table 3.1-5. The results indicate an association between TSS and total arsenic, copper, manganese, and zinc at a probability level of 95 percent and support the inference regarding the contribution of reservoir sediments to trace metal increases at this station. Pearson correlation coefficients confirm this relationship. Lead concentrations failed to show this association.

3.1.3 DATA COMPARISON

The samples analyzed during the surface water subtask were collected by Montana Power Company's consultant. CDM field representatives witnessed each sampling and obtained splits from the sampling personnel. Sample collection was conducted in accordance with standard USGS procedures, at USGS gauging stations, using USGS equipment. However, both sets of samples were not analyzed at the same laboratory. Table 3.1-6 presents a comparison of the results from both labs for each station. MPC was more selective in their sampling frequency and choice of trace element analyses. MPC collected daily samples for suspended sediment and bi-weekly samples for dissolved and total recoverable arsenic, copper, and zinc. For data pairs above detection limits, CDM's data were generally higher than MPC's. This was particularly evident for samples collected on July 4th. Of the

TABLE 3.1-5

REGRESSION RESULTS TESTING THE RELATIONSHIP BETWEEN
TOTAL SUSPENDED SEDIMENT AND TOTAL METALS AT
THE EAST MISSOULA STATION^a

	As	Cu	Mn	Pb	Zn
Probability $\geq .95$	*	*	*	NS	*
Correlation Coefficient	.614	.703	.668	.213	.519

* = Significant

NS = Non-significant

^aN = 15 samples/analyte

TABLE 3.1-6

SURFACE WATER QUALITY - COMPARISON OF MPC AND
DOWNSTREAM SCREENING STUDY LAB RESULTS

		East Missoula Station					
Date	Sampler	Arsenic (µg/l)		Copper (µg/l)		Zinc (µg/l)	
		Diss. ^a	TRC ^b	Diss. ^a	TRC ^b	Diss. ^a	TRC ^b
6/27/88	CDM	2.9	<3.9	< 6.0	<17.0	22.4	<11.0
	MPC	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0
6/30/88	CDM	2.8		<6.0		5.1	
	MPC	<5.0		<10.0		<10.0	
7/4/88	CDM	4.0	<3.9	24.4	<22.0	31.2	<12.0
	MPC	<5.0	13.0	<10.0	<10.0	<10.0	<10.0
7/7/88	CDM	3.7		<6.0		16.1	
	MPC	<5.0		<10.0		<10.0	
7/9/88	CDM	3.3		8.2		8.4	
	MPC	<5.0		<10.0		<10.0	
7/10/88	CDM	3.7		<6.0		12.5	
	MPC	<5.0		<10.0		<10.0	

TABLE 3.1-6 (cont.)

SURFACE WATER QUALITY - COMPARISON OF MPC AND
DOWNSTREAM SCREENING STUDY LAB RESULTS

Date	Sampler	East Missoula Station					
		Arsenic ($\mu\text{g/l}$)		Copper ($\mu\text{g/l}$)		Zinc ($\mu\text{g/l}$)	
		Diss. ^a	TRC ^b	Diss. ^a	TRC ^b	Diss. ^a	TRC ^b
6/27/88	CDM MPC	<2.0 <5.0	<3.9 <5.0	7.4 <10.0	<17.0 20.0	18.5 <10.0	<11.0 10.0
6/30/88	CDM MPC	<2.0 <5.0		<6.0 <10.0		6.3 <10.0	
7/4/88	CDM MPC	<2.0 <5.0	<3.9 <5.0	17.3 <10.0	<22.0 <10.0	9.3 <10.0	<12.0 <10.0
7/7/88	CDM MPC	<2.0 10.0		9.0 <10.0		4.8 <10.0	
7/9/88	CDM MPC	<2.0 <5.0		11.8 <10.0		181.0 ^c <10.0	
7/10/88	CDM MPC	<2.0 <5.0		<6.0 <10.0		13.1 <10.0	

TABLE 3.1-6 (cont.)

SURFACE WATER QUALITY - COMPARISON OF MPC AND
DOWNSTREAM SCREENING STUDY LAB RESULTS

		East Missoula Station					
Date	Sampler	Arsenic ($\mu\text{g/l}$)		Copper ($\mu\text{g/l}$)		Zinc ($\mu\text{g/l}$)	
		Diss. ^a	TRC ^b	Diss. ^a	TRC ^b	Diss. ^a	TRC ^b
6/27/88	CDM MPC	4.7 <5.0	4.6 <5.0	<6.0 <10.0	<17.0 <10.0	23.0 <10.0	<11.0 <10.0
6/30/88	CDM MPC	6.5 5.0		<6.0 <10.0		7.3 <10.0	
7/4/88	CDM MPC	5.2 12.0	5.8 12.0	13.1 10.0	<22.0 <10.0	11.4 <10.0	<12.0 <10.0
7/7/88	CDM MPC	5.6 <5.0		10.3 <10.0		8.3 <10.0	
7/9/88	CDM MPC	6.9 5.0		8.4 <10.0		17.1 <10.0	
7/10/88	CDM MPC	6.1 <5.0		7.1 <10.0		13.1 <10.0	

^a Dissolved Concentration^b Total Recoverable Concentration^c Outlier

three stations, East Missoula showed more variability than the others. Overall, no gross chemistry differences were apparent.

As a check on sampling procedures, the USGS collected samples concurrently with ours on two occasions during the sampling period. Samples were placed in CDM's custody and analyzed through the CLP. Results of these analyses are in Table 3.1-7. No obvious trends are apparent. Most pairs of data fall generally within an acceptable 20 percent of one another.

3.1.4 BED SEDIMENTS

River bed sediments were obtained from the Blackfoot and Clark Fork rivers between June 27, 1988 and July 27, 1988. By design, this sampling effort coincided with the drawdown occurring at Milltown Reservoir. Sampling locations were restricted to the active channel at the following sites: the USGS gauging stations near Bonner on the Blackfoot River, on the Clark Fork at Turah, and below the reservoir at East Missoula. At each station, fine grained sediment grab samples were collected from obvious areas of deposition along the shore below the active water level. During field preparation, the samples were dried and sieved into two size fractions, <63 micron fraction and >63 micron fraction. Both size fractions were analyzed for trace metal concentrations. The results of these analyses are presented in Table 3.1-8. The Bonner Station, as was expected, exhibited the lowest values for both size fractions. Values fall within the range of background concentrations identified by previous studies (Woessner et al., 1984; Moore et al., 1987). The Turah and East Missoula Station values varied somewhat. East Missoula showed higher mean concentrations in the smaller size fraction whereas Turah demonstrated the opposite, higher mean values in the larger size fractions. When the data are graphed, Figures 3.1-3 and 3.1-4 for instance, the values for both size fractions at East Missoula appear to increase slightly through the drawdown period. This trend is not as apparent in the Turah samples.

TABLE 3.1-7
SURFACE WATER QUALITY COMPARISON
OF USGS AND DOWNSTREAM SCREENING STUDY
LAB RESULTS

Date	Arsenic ^a	Cadmium	Copper	Manganese	Lead	Zinc
6/27	(Clark Fork at Turah)					
Total	5.2 { 4.9 } ^b	<5.0 { <5.0 }	9.5 { 8.8 }	19.6 { 20.2 }	2.5 { 6.2 }	21.7 { 21.0 }
Dissolved	4.7 { 4.9 }	<5.0 { <5.0 }	<6.0 { 6.0 }	7.3 { 8.7 }	5.3 { <2.0 }	23.0 { 18.7 }
TRC	4.6 { <3.9 }	<4.2 { <4.2 }	<17.0 { <17.0 }	13.9 { <9.3 }	1.3 { <0.9 }	<11.0 { <11.0 }
7/6						
Total	5.5 { 5.7 }	<5.0 { <5.0 }	25.4 { 21.7 }	28.3 { 31.0 }	13.3 { 5.7 }	26.1 { 28.0 }
Dissolved	5.2 { 5.4 }	<5.0 { <5.0 }	18.3 { 16.6 }	7.2 { <7.0 }	7.4 { 4.4 }	15.4 { 13.8 }
TRC	4.9 { 6.8 }	<3.7 { 4.4 }	<22.0 { <22.0 }	6.6 { 22.5 }	1.8 { 1.5 }	22.8 { 15.1 }
6/27	(Blackfoot River)					
Total	<2.0 { <2.0 }	<5.0 { <5.0 }	31.5 { <6.0 }	10.8 { 13.2 }	16.8 { 7.4 }	21.0 { 21.0 }
Dissolved	<2.0 { <2.0 }	<5.0 { <5.0 }	7.4 { <6.0 }	<7.0 { 7.0 }	7.1 { 4.5 }	18.5 { 12.0 }
TRC	<3.9 { <3.9 }	<4.2 { <4.2 }	<17.0 { <17.0 }	11.3 { <9.3 }	21.6 { 2.4 }	<11.0 { <11.0 }
7/6						
Total	<2.0 { <2.0 }	<5.0 { <5.0 }	15.9 { 11.5 }	10.1 { 8.5 }	7.5 { 7.2 }	20.5 { 8.3 }
Dissolved	<2.0 { <2.0 }	<5.0 { <5.0 }	10.5 { 11.5 }	<7.0 { <7.0 }	3.0 { 3.7 }	6.4 { 15.7 }
TRC	<3.9 { <3.9 }	<3.7 { <3.7 }	<22.0 { <22.0 }	6.1 { 6.3 }	1.0 { 1.1 }	<12.0 { <12.0 }
6/27	(Clark Fork at East Missoula)					
Total	<2.0 { 3.1 }	<5.0 { <5.0 }	7.4 { 7.8 }	<7.0 { 40.7 }	4.1 { 3.4 }	19.2 { 23.3 }
Dissolved	2.9 { 3.0 }	<5.0 { <5.0 }	<6.0 { 6.0 }	26.6 { 25.8 }	<2.0 { <2.0 }	22.4 { 11.2 }
TRC	<3.9 { <3.9 }	<4.2 { <4.2 }	<17.0 { <17.0 }	32.0 { 29.2 }	1.2 { <0.9 }	<11.0 { <11.0 }
7/6						
Total	4.1 { 4.8 }	<5.0 { <5.0 }	25.8 { 31.6 }	81.1 { 76.3 }	5.9 { 8.5 }	43.8 { 47.6 }
Dissolved	3.1 { 3.2 }	<5.0 { <5.0 }	9.1 { 13.8 }	45.1 { 45.6 }	4.5 { 2.7 }	7.6 { 14.3 }
TRC	<3.9 { 5.0 }	<3.7 { <3.7 }	26.2 { 26.3 }	80.3 { 78.2 }	2.7 { 3.3 }	26.3 { 36.2 }

^a All values are in µg/l

^b USGS values are in parentheses

^c TRC = Total Recoverable Concentration

TABLE 3.1-8
RESERVOIR DRAWDOWN - RIVER SEDIMENT SAMPLES
DATA SUMMARY

Collection Date	Turah Station		Bonner Station		East Missoula Station	
	<63um	>63um	<63um	>63um	<63um	>63um
Arsenic (mg/kg)						
6/27	29.2	12.8	5.5	5.2	18.5	5.9
7/6	17.4	10.8	6.9	9.7	24.8	5.5
7/10 ^a	-	-	-	-	32.6	6.0
7/25	22.6	9.8	3.2	2.7	24.7	6.1
7/27	28.2	13.8	4.4	3.9	41.8	8.7
Mean	24.3	11.8	5.0	5.4	28.5	6.4
Cadmium (mg/kg)						
6/27	1.6	1.0	.32	<.27	1.8	.35
7/6	1.3	.53	.42	2.1	1.7	.3
7/10 ^a	-	-	-	-	2.1	.28
7/25	1.8	.78	<.34	<.24	1.7	.33
7/27	2.2	1.0	<.33	<.28	2.8	.48
Mean	1.7	.82	<.35	<.72	2.0	.35
Copper (mg/kg)						
6/27	255	131	15.1	19.9	209	55.5
7/6	198	107	15.8	20.1	304	50.2
7/10 ^a	-	-	-	-	402	49.3
7/25	220	80.5	18.0	16.1	250	14.5
7/27	276	158	14.8	13.3	393	76.1
Mean	237.2	119.1	15.9	17.3	311.6	49.1
Lead (mg/kg)						
6/27	52.1	30.7	10.4	10.9	40.7	13.9
7/6	37.7	28.3	10.3	11.6	35.7	13.7
7/10 ^a	-	-	-	-	45.6	14.3
7/25	58.1	23.1	12.4	5.6	40.6	13.9
7/27	55.5	36.4	13.9	6.9	51.3	17.4
Mean	50.8	29.6	11.7	8.7	42.8	14.6

TABLE 3.1-8 (cont.)

RESERVOIR DRAWDOWN - RIVER SEDIMENT SAMPLES
DATA SUMMARY

Collection Date	Turah Station		Bonner Station		East Missoula Station	
	<63um	>63um	<63um	>63um	<63um	>63um
Zinc (mg/kg)						
6/27	623	426	44.4	43.4	695	277
7/6	514	368	43.9	48.1	754	251
7/10 ^a	-	-	-	-	794	248
7/25	577	284	44.9	31.8	946	273
7/27	643	439	45.2	38.9	846	317
Mean	589	379.2	44.6	40.5	807	272.6

^a Opportunistic sample collected at East Missoula Sampling Station only.

Comparison of Size Fractions
Clark Fork - East Missoula Station

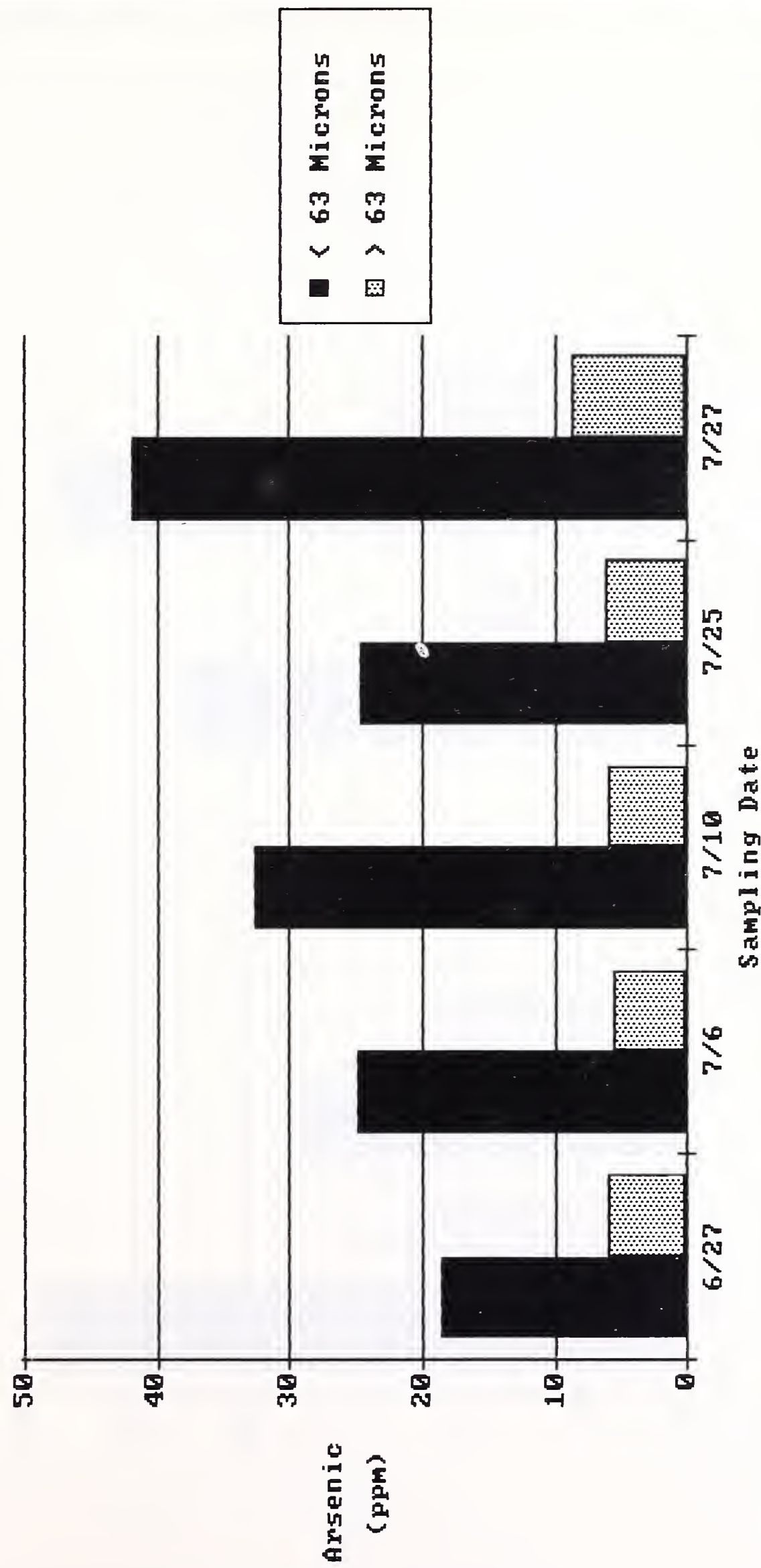


Figure 3.1-3

Comparison of Size Fractions
Clark Fork - Turah Station

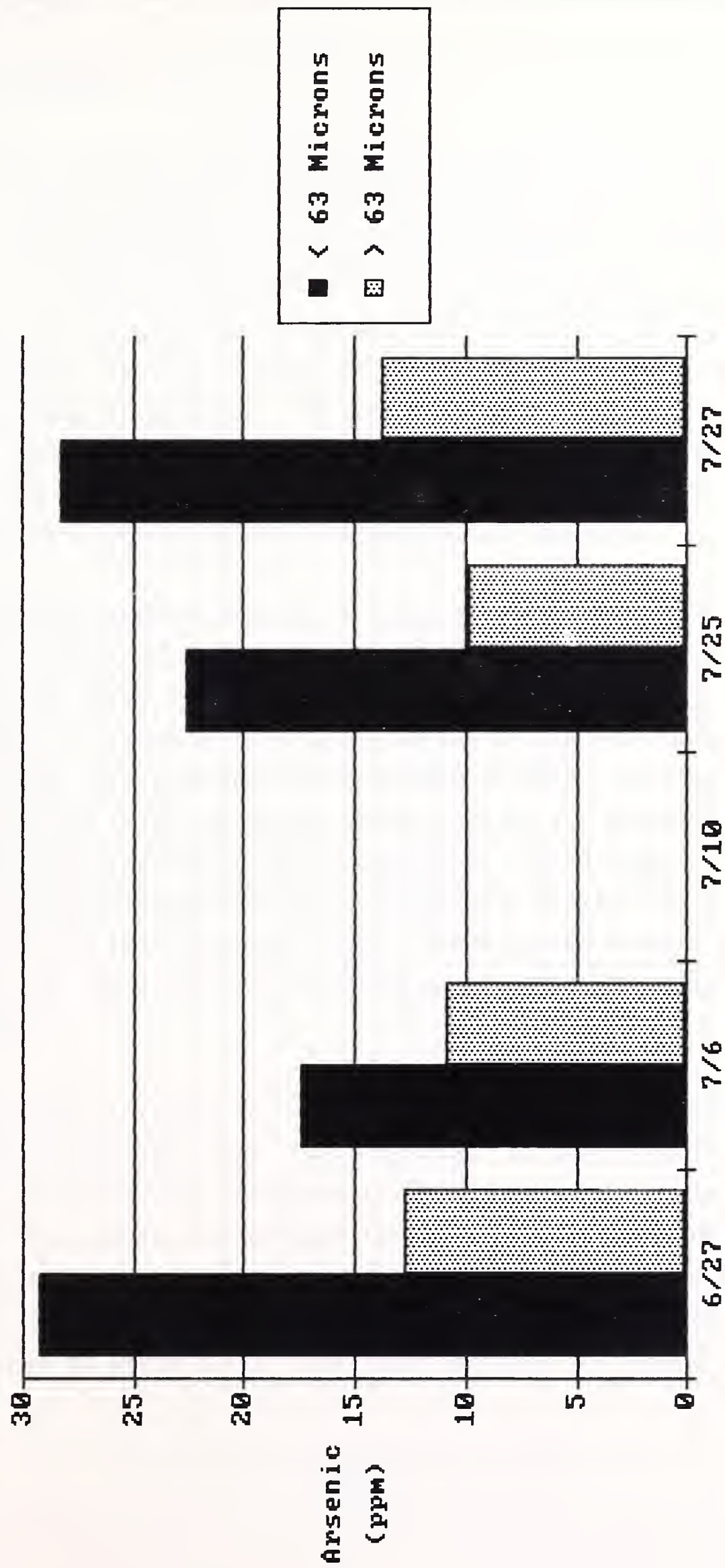


Figure 3.1-4

3.2 GROUND WATER

3.2.1 WELL INVENTORY

A domestic well inventory was conducted downstream of the Milltown Reservoir. A search of water rights applications on file with the Montana Department of Natural Resources and Conservation generated a list of approximately 79 wells located between Milltown and Hellgate Canyon. This area encompasses the communities of West Riverside, Pinegrove, and East Missoula. These wells have been filed with MDHES in the form of a computer printout. Records of Community Water Supplies and Public Water Supplies were obtained from MDHES Water Quality Bureau. Much of East Missoula relies on water supplied by the Mountain Water Company from a supply well located on Fifth Street in East Missoula.

The Mountain Water Company operates 34 wells (Table 3.2-1) serving approximately 45,000 residents in the city of Missoula, beyond Hellgate Canyon. Eight of these wells are located within a quarter mile of the Clark Fork River. The Clark Fork Water Company is the next largest supplier of water servicing approximately 2300 persons. The Missoula aquifer is the only source of ground water utilized for Missoula municipal supplies (Missoula City-County Health Department, MCCHD 1988). It is comprised of unconsolidated and older consolidated valley fill deposits of fluvial, lacustrine and colluvial origin. The Clark Fork River is identified as the major source of recharge to the Missoula aquifer (Woessner, 1988).

Wells of particular interest to this study are those located adjacent to, and immediately downstream from, the reservoir. As described in Section 2.0, the well inventory was performed to identify specific wells for two purposes: 1) To provide static water levels for determining the direction of ground water flow; and 2) To provide an indication of ground water quality. The wells selected for monitoring during the Downstream Screening Study are listed in Table 3.2-2. The table provides the sample ID numbers

TABLE 3.2-1
MOUNTAIN WATER COMPANY WELLS
Missoula Division

No.	Location	Year Installed	Depth (feet)	Casing Size	Yield GPM ^a
1	S. 6th & Ivy	1935	122	12"	1,000
2	S. 14th Street	1935	90	12"	1,000
3	South Avenue	1935	116	12"	1,000
4	East Missoula #1	1937-1954	86	10"	290
7	Russell Street - Service Center	1951-1953	110	14"	1,000
8	Schilling Street	1954	117	12"	1,000
9	Dixon Avenue	1954	132	12"	1,000
10	Hilda & Beckwith	1957	146	12"	1,075
11	Agnes Avenue	1957	118	12"	1,000
12	East Missoula #2	1964	107	12"	760
13	Mountain View Drive	1954	127	12"	330
14	South Russell	1965	113	12"	1,008
16	24th Street	1966-1969	120	12"	580
17	Industrial Park - Momont	1968	360	16"	670
18	Charrett Street	1968	106	16"	620
19	North Russell	1969	110	16"	1,100
20	Catlin Street	1969	143	16"	1,275
21	East Central	1969	137	16"	1,250
22	Intermountain	1949	92	12"	990
23	Pattee Creek Drive	1945	116	8"	205
24	Pattee Creek Drive - Acquired with Farviews	1955	120	12"	450
25	Stephens Avenue - System 1973	1966	146	14"	800
26	Benton Avenue	1971-1972	125	16"	1,050
27	26th Street	1972	125	16"	500
28	DeSmet - C & N	1972	375	6"	25
29	Orchard Avenue	1973	136	16"	880
30	#1 Sub	1973-1974	158	18"	3,250
31	Kiwanis Street	1975-1976	135	18"	3,500
32	Arthur Avenue	1975-1976	139	18"	3,100
33	4th and Gerald	1976-1977	147	18"	3,600
34	Maurice Avenue	1977-1978	134	18"	6,500
35	South Gate	1978	145	18"	2,000
36	Dickens	-	-	-	1,000
37	South Avenue	-	-	-	2,300

^a Gallons per minute

TABLE 3.2-2

WELLS MONITORED DURING DOWNSTREAM SCREENING STUDY

Well ID No.	Well Type	Static Water Level ^a	Sampled ^b
2	Domestic Supply	X	
3	Community Supply	X	
4	Community Supply	X	
5	Community Supply	X	
6	Domestic Supply	X	
7	Domestic Supply	X	
8	Monitoring	X	
9	Monitoring	X	
108a	Monitoring	X	
108b	Monitoring	X	
109a	Monitoring	X	
109b	Monitoring	X	
AC	Commercial Supply	X	*
A2	Domestic Supply	X	*
A3	Domestic Supply	X	*
A4	Domestic Supply	X	*
A14	Commercial Supply	X	
C2a	Community Supply		*
C2b	Community Supply		*
C4	Abandoned Supply	X	
C8	Commercial Supply	X	*
C-21	Commercial Supply		*
DW-9	Commercial Supply		*
DW-13	Domestic Supply	X	*
HB	Domestic Supply	X	*
HLA-1	Monitoring	X	*
HLA-2	Monitoring	X	*
M16	Commercial Supply	X	*
M17	Abandoned Supply	X	*
M19	Community Supply		*
OH	Domestic Supply		*

^a X = Water level measured

^b * = Ground water sample collected

used, well type, and whether it was monitored for static water levels, sampled, or both. Static water levels were measured twice during the study period, July 1988 and January 1989. Sampling of the wells was conducted only once, in November 1988. Figure 3.2-1 shows the locations of these wells.

3.2.2 POTENTIAL FOR CONTAMINATION OF THE MISSOULA SOLE SOURCE AQUIFER

The SSA petition cites the Milltown Dam sediments as a potential source of contamination to the Missoula Valley Aquifer via recharge from the Clark Fork River. This conclusion was based on mass balance analysis conducted initially by Clark (1986). This analysis was later revised by Woessner (1988), which revealed that on an annual basis approximately 16 percent (412,700 acre-ft/yr) of the flow in the Clark Fork above Missoula recharges into the Missoula Valley Aquifer over a four to six mile reach of the river. According to these analyses, this recharge accounted for 46 percent (Clark 1986) and 90 percent (Woessner 1988) of the total recharge into the Missoula Valley Aquifer. This inconsistency is apparently due to an error made by Clark (1986) in his computations, and the Woessner (1988) results are therefore more accurate. It should be pointed out, however, that the 90 percent is an approximation based on quantifiable recharge sources.

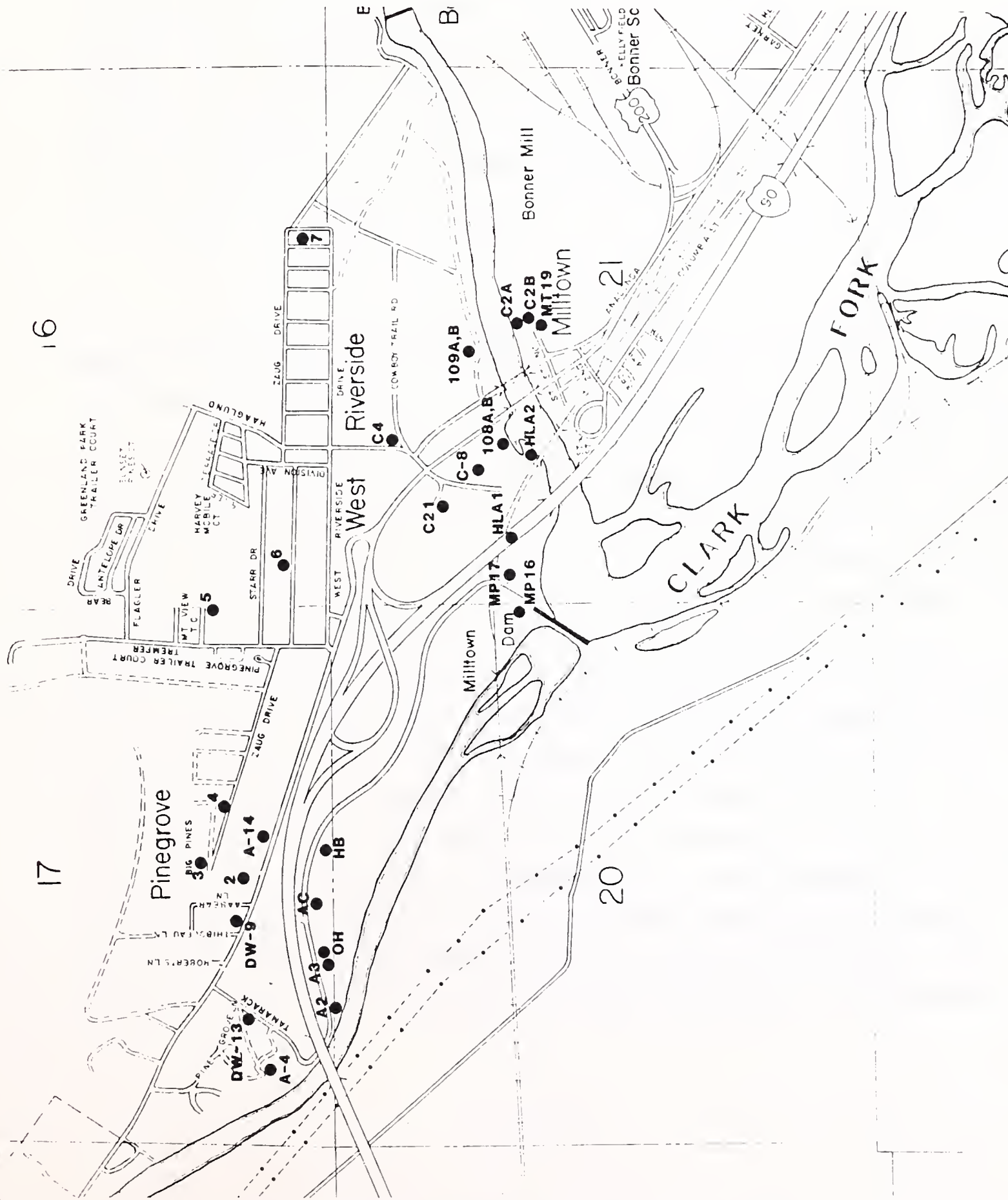
Since the total water budget of recharge and discharge sources presented in either report represent only approximations, it is impossible to determine conclusively that the Clark Fork River contributes 90 percent of the recharge into the aquifer. The mass balance analysis (Woessner, 1988) was limited primarily to the accounting of the surface water inflows only. Local and regional ground water inflows are extremely difficult to estimate and quantify for budget purposes. The difficulty lies in determining proportionally how much of the total recharge can be attributed to the Clark Fork River versus other sources, although the data indicate that it is undoubtedly a primary contributor. The ground water flow model developed by Woessner (1988) for the site should be used to evaluate an

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EXPLANATION

- MONITOR LOCATION (SEE TABLE FOR ADDITIONAL INFORMATION)



MILLTOWN DOWNSTREAM SCREENING STUDY	FIGURE 3.2-1
MONITOR WELL LOCATIONS	CDM
CAMP DRESSER & MCKEE INC	

overall water balance, and quantify the various sources of recharge and discharge.

Existing surface water quality was determined by review of data from the MDHES monitoring program for the periods March 1984 through June 1988. Data from several stations within the study area were evaluated. These were the Clark Fork below Milltown Dam, the Clark Fork above Missoula, and the Clark Fork above the Missoula Wastewater Treatment Plant. Particular attention was given to suspended solids, total recoverable metals (iron, copper, zinc, manganese, cadmium, and arsenic), and acid soluble metals (copper, zinc, cadmium, and lead) data from the seasonal shallow water monitoring programs. Although water quality degrades downstream from the Hellgate Canyon east and southeast towards the Bitterroot River, there is no indication of any elevated levels of metals and/or suspended solids that are currently a problem or exceed any standards.

The potential for contaminating the ground water aquifer exists due to the significant contribution of recharge from the Clark Fork River. This threat is more serious to the wells nearest the river deriving their water as a result of direct recharge from the river. The Mountain Water Company supplies water to Missoula residents through 34 supply wells, all within the Missoula aquifer. Several of the more productive wells are located within a few hundred feet of the river. Release of sediments from the Milltown Reservoir could result in the dissolution of trace elements if favorable geochemical conditions exist, to the surface water which recharges the aquifer or directly into the ground water of the Missoula Valley Aquifer. Wells could subsequently be impacted, especially those in close proximity to the Clark Fork River. The extent and magnitude of this impact area cannot be determined with the available information. Due to the coarse nature of the Missoula aquifer, attenuation from geochemical processes such as sorption, ion exchange, etc. would probably be limited. If trace metal concentrations become elevated, then the only apparent significant attenuation mechanism would be dilution from mixing with existing clean water. Since dilution is so important, it is necessary to

the recharge/discharge balance within the aquifer and the proportion of contribution from the Clark Fork River. Once these relationships are established, it will be possible to evaluate worst-case type scenarios under which sediments released from the dam are involved. The recommended approach is to perform simple mixing calculations to determine the net ground water quality after the individual components could be quantified through additional data collection and modeling efforts.

3.2.3 WATER LEVEL MEASUREMENTS

Static water level measurements in local wells were monitored twice during the Downstream Screening Study. The first measurement was conducted in August 1988 and included 11 wells. During this period the Milltown Reservoir level had been drawn down to permit access for rehabilitation work to the dam. The second measurement was conducted in January 1989 and encompassed 21 wells. The Milltown Reservoir had been refilled at this time after completion of a coffer dam. The results of the water level measurements are shown in Table 3.2-3.

Figure 3.2-2 is a water table contour map developed using available water level data from August 1988. The contours shown are located by interpolation between data points. Their location must be considered to be approximate, especially in the central portion of the study area due to the paucity of control. The map implies that ground water flow is to the west-northwest from the Blackfoot River along the Clark Fork River. At the west end of the study area, it appears that the flow direction becomes more westerly, somewhat toward the Clark Fork River. The gradient averages 0.003 feet per foot between wells 109B and AC, but is flatter in the central part of the study area.

A similar map (Figure 3.2-3) was developed utilizing the January 1989 water level data. In general, water levels rose 1 to 3 feet during this period, with HLA-1 rising 4.68 feet and C-8 rising 5.02 feet. The increase over this period could be a result of normal seasonal fluctuations and/or

TABLE 3.2-3
WATER LEVEL MEASUREMENTS

Name ^a	Measuring Point Elevation	Water Level Elevation		Elevation Change (feet)
		August 1988	January 1989	
2	3,280.98	3,213.32	3,215.04	+1.72
3	3,278.06	3,213.96	-	-
4	3,280.03	3,214.95	-	-
5	3,288.53	3,218.35	3,221.21	+2.86
6	3,288.27	3,219.5	3,222.69	+3.19
7 ^b	3,278.53	3,200.61	3,203.25	+2.64
108A	3,271.00	-	3,240.07	-
108B	3,271.02	-	3,239.94	-
109A	3,276.43	3,235.85	3,233.1	-2.75
109B	3,278.49	3,230.66	3,244.03	+13.37
AC	3,258.63	3,211.38	3,212.45	+1.07
A-2	3,261.4	-	3,211.35	-
A-3	3,233.8	-	3,206.82	-
A-4	3,258.6	-	3,209.7	-
A-14	3,283.8	-	3,219.55	-
C-4	3,288.24	-	3,227.21	-
C-8	3,276.1	3,229.28	3,234.3	+5.02
DW-13	3,263.1	-	3,211.95	-
HB	3,271.9	-	3,215.65	-
HLA-1	3,301.83	3,228.04	3,232.72	+4.68
HLA-2	3,260.6	-	3,238.98	-
M-16	3,274.44	-	3,232.36	-
M-17	3,273.1	-	3,229.81	-

^a See Table 3.2-2 for key to well use and Figure 3.2-1 for location.

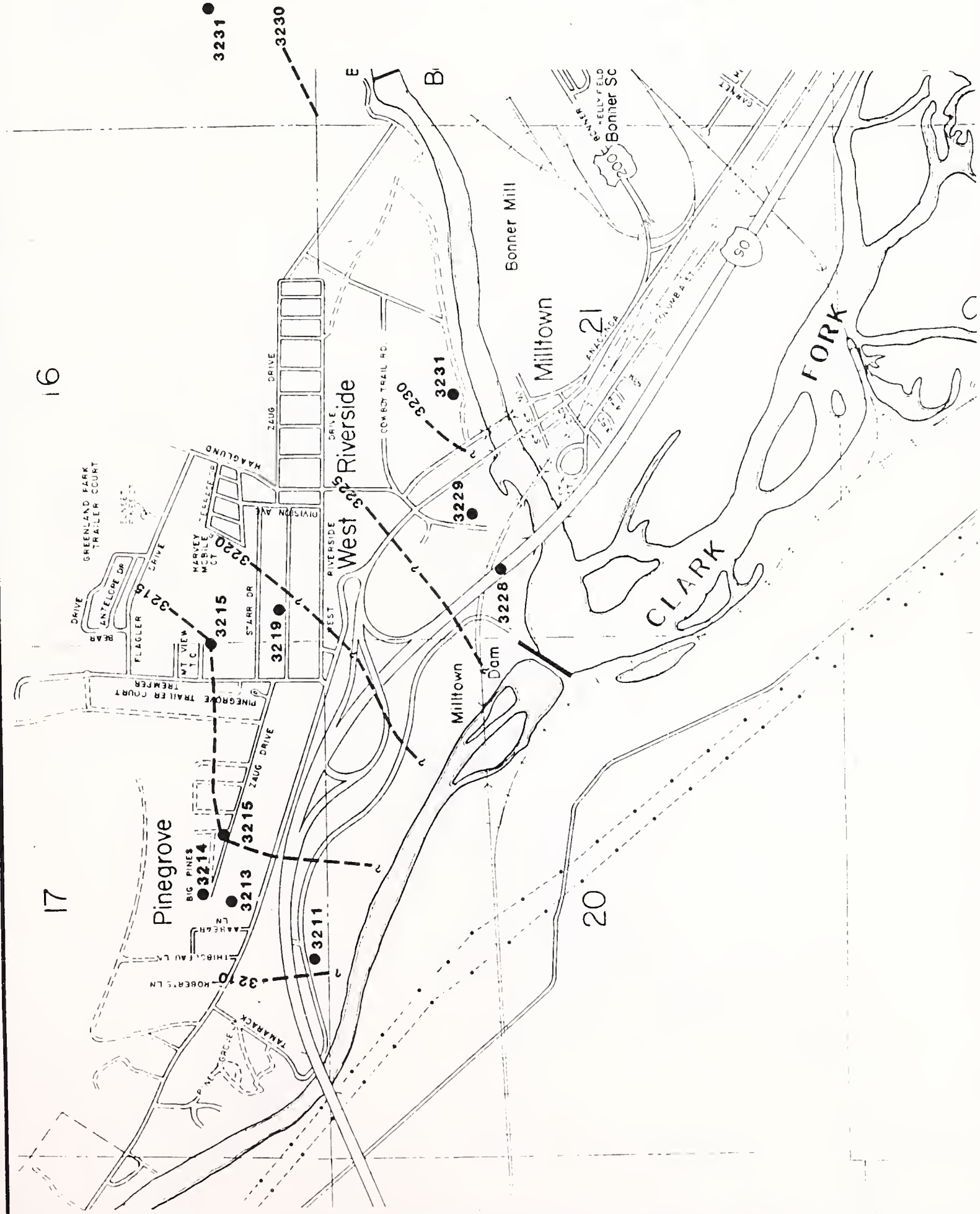
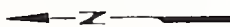
^b May be separate hydrogeologic regime, values not used in analysis.

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EXPLANATION

- MONITOR WELL SHOWING WATER TABLE ELEVATION MEASURED IN AUGUST, 1988
- GROUND WATER TABLE CONTOUR (5 FOOT CONTOUR INTERVAL, LOCATION APPROXIMATE)



MILLTOWN DOWNSTREAM SCREENING STUDY	FIGURE 3.2-2
GROUND WATER CONTOUR MAP AUGUST, 1988	CDM
CAMP DRESSER & MCREE, INC.	

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EXPLANATION

- 3244
MONITOR WELL SHOWING
WATER TABLE ELEVATION
MEASURED IN JANUARY, 1989
- 3240
GROUND WATER TABLE CONTOUR
(5 FOOT CONTOUR INTERVAL,
LOCATION APPROXIMATE)



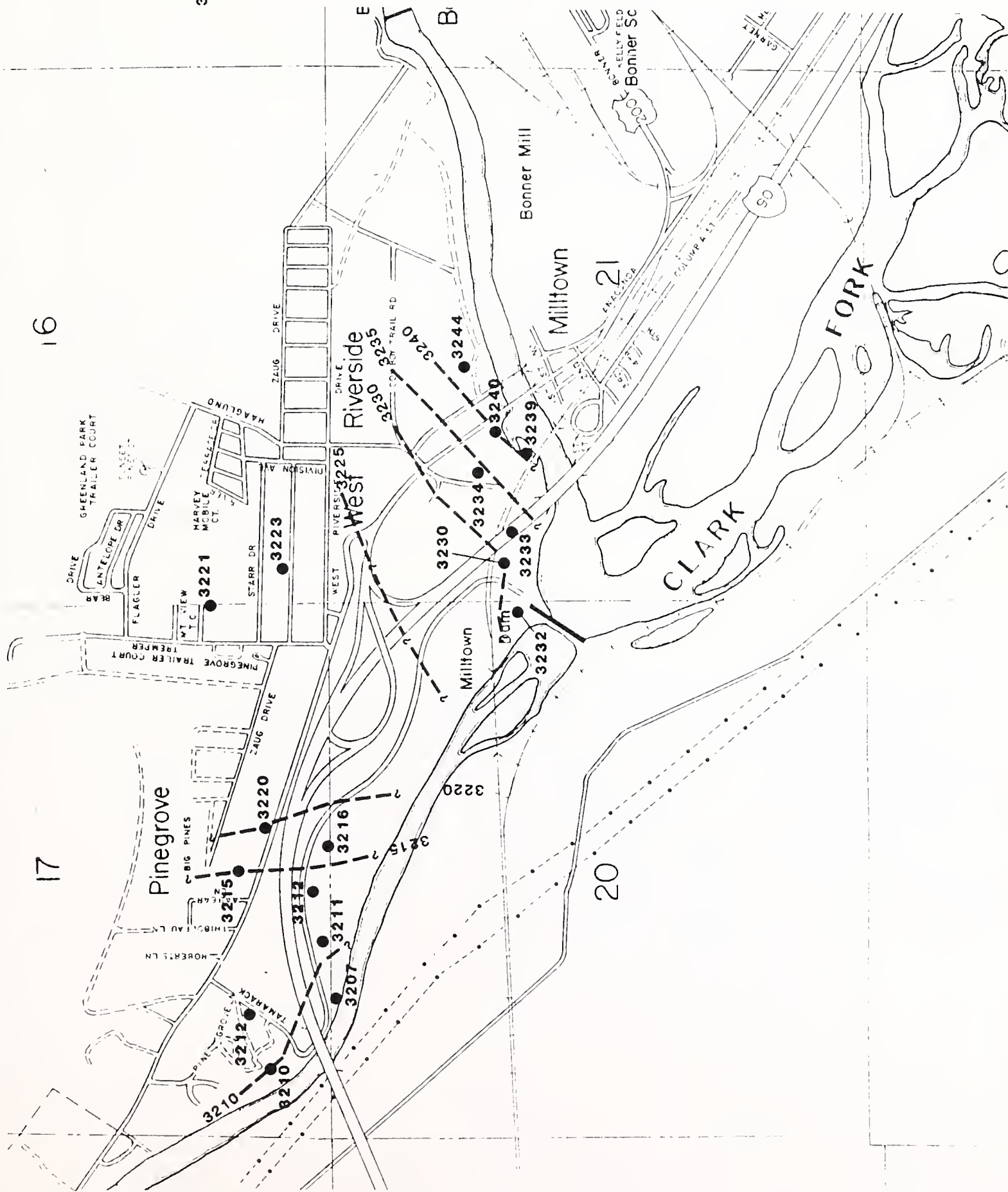
MILLTOWN DOWNSTREAM
SCREENING STUDY

GROUND WATER CONTOUR MAP
JANUARY, 1989

CAMP DRESSER & MCKEE INC.

FIGURE
3.2-3

CDM



response to a higher pool elevation in Milltown Reservoir. The 13+ foot rise in the water level in Well 109B is probably closely related to the increase in the reservoir level. The contours indicate flow to the northwest becoming west and then southwest over the study area. A northerly component appears to exist near Milltown Dam and probably indicates recharge to the aquifer from the reservoir at the right abutment. The gradient is steeper (0.018 feet per foot) at the eastern part of the study area but flatter near the middle (0.003 feet per foot) and averages 0.006 feet per foot between wells 109B and AC. The steeper gradient is probably a result of renewed recharge to the aquifer from the Blackfoot River in response to raising the pool elevation in the reservoir. The pronounced flattening and apparent change in flow direction in the central portion of the study area implies that another area of recharge exists to the north-northeast.

The water level data collected during the Pownstream Screening Study is generally consistent with that collected during previous investigations. No marked variations are observed in the ground water flow path with that presented in the Revised Basic Data Report (HLA 1986), even though many of the wells measured were different.

3.2.4 GROUND WATER QUALITY

3.2.4.1 Inorganic Contaminant Plume Investigation

Based on ground water quality sampling performed during investigations of the Milltown Reservoir Sediments CERCLA site the existence of a plume of ground water with slightly elevated levels of arsenic has been postulated (HLA 1986). The plume (Figure 3.2-4) was reported to originate beneath the reservoir sediments and extend to the northwest, generally along the alignment of Interstate Highway 90. This phase of the Downstream Screening Study was to resample wells in the area of this plume in order to verify the results of the HLA investigation.

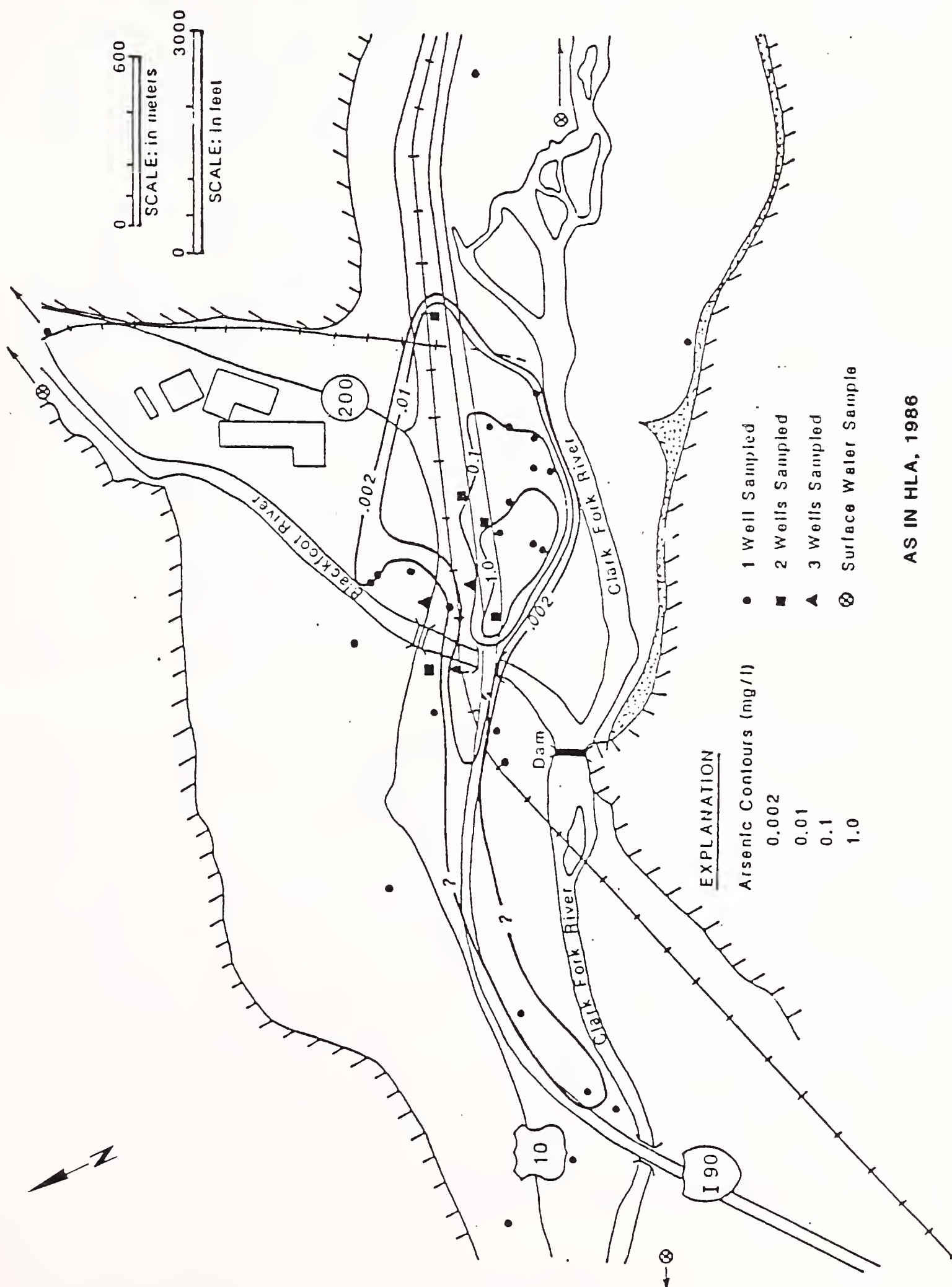


Figure 3.2-4 Arsenic Concentrations in Ground Water June 10-23, 1986.

Fourteen domestic supply and monitoring wells were sampled in November, 1988. The analysis results are presented in Appendix 5.2 along with field measurements. Table 3.2-4 summarizes the data for selected analytes and also presents corresponding values reported by HLA for comparison. In general, the Downstream Screening Study results appear to be consistent with those presented in the HLA report.

Ground water in the study area is of the calcium bicarbonate type in each of the wells sampled, and appears to be of relatively high quality. The trace elements of antimony, beryllium, cadmium, chromium, cobalt, mercury, nickel, silver, thallium and vanadium were not detected in any of the ground water samples. Copper was detected in one sample (C-8), selenium in three samples (A-4, DW-13 and M-17) and lead in four samples (C-8, DW-13, DW-9, and M-16). Additional constituents detected are presented on Table 3.2-4 and include arsenic (14 samples), iron (6 samples), manganese (10 samples) and zinc (6 samples). Water from each of the supply well samples is well within established standards for drinking water. The three monitoring wells exceeded secondary standards for iron and manganese. HLA-1 and HLA-2 both exhibited levels of arsenic exceeding the primary standard for arsenic.

Arsenic concentrations in the ground water were of primary interest in this phase of the Downstream Screening Study Investigations. Arsenic was detected in each of the ground water samples ranging between 2.1 $\mu\text{g/l}$ (C-21) and 173 $\mu\text{g/l}$ (HLA-1). All values are well within the 50 $\mu\text{g/l}$ primary MCL established for drinking water except HLA-1 and HLA-2. These two ground water monitoring wells were installed during the HLA investigations for the purpose of monitoring trace metal contamination down-gradient of the Milltown Reservoir sediments. They are located on the west bank of the Blackfoot River, just upstream of the Milltown dam. The arsenic levels yielded by the Downstream Screening Study sampling do exhibit an increase over those reported by the HLA study for every well sampled in both studies. This could indicate a progressive deterioration of ground water quality through continued release of contaminants from the

TABLE 3.2-4

RESULTS OF GROUND WATER SAMPLE ANALYSES FOR SELECTED ANALYTES

Parameter	Units	Well AC		Well A2		Well A3		Well A4		Well C8		Well C-21		Well DW-9	
		HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b
<u>Field Measurement</u>															
Temperature	C°	-	10.1	-	9.7	10.1	9.6	-	9.2	12.9	-	12.7	-	-	8.9
Conductivity	umhos/cm 25°C	-	288	-	315	220	319	-	298	191	293	0	268	-	243
pH	S.U.	-	7.5	-	7.3	7.5	7.5	-	7.4	7.8	7.5	-	7.3	-	7.2
Redox Potential	M.V.	-	+341	-	+471	+521	+401	-	+301	+576	+449	-	+389	-	+516
<u>General Chemistry</u>															
Calcium	mg/l	-	42.4	-	43.7	50	45.2	-	40.4	38	39.9	-	35.9	-	32.0
Magnesium	mg/l	-	10.2	-	11.5	13	11.9	-	11.2	11	11.0	-	10.6	-	9.8
Potassium	mg/l	-	1.3	-	1.4	1.3	1.4	-	1.3	1.3	1.3	-	1.2	-	1.1
Sodium	mg/l	-	4.1	-	5.1	4.9	5.4	-	5.4	5.8	5.4	-	4.8	-	4.2
Chloride	mg/l	-	1.2	-	1.9	ND ^e	1.9	-	2.0	ND	1.9	-	1.6	-	1.5
Sulfate	mg/l	-	8.2	-	15.2	14	15.0	-	18.1	18	19.9	-	12.3	-	9.9
Total Alk as CaCO ₃	mg/l	-	154	-	160	169	158	-	145	127	139	-	132	-	123
TDS	mg/l	-	119	-	156	-	139	-	151	-	13.7	-	25	-	185
<u>Trace Metals</u>															
Arsenic	µg/l	-	2.3	-	7.5	<2	6.3	-	3.8	<2	2.7	-	2.1	-	2.5
Iron	µg/l	-	<22.6	-	29.8	ND	<22.6	-	<22.6	ND	<22.6	-	<22.6	-	<22.6
Manganese	µg/l	-	3.2	-	3.5	ND	<1.8	-	<1.8	ND	4.2	-	22.7	-	<1.8
Zinc	µg/l	-	18.2	-	<11.7	16	<11.7	-	<11.7	19	81.5	-	<11.7	-	22.7

TABLE 3.2-4 (cont.)

RESULTS OF GROUND WATER SAMPLE ANALYSES FOR SELECTED ANALYTES

Parameter	Units	Well DW-13		Well HB		Well HLA-1		Well HLA-2		Well M-16		Well M-17		Well OH		Drinking Water
		HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	HLA ^a	DSS ^b	
<u>Field Measurement</u>																
Temperature	C°	10.0	9.1	6.5	10.8	8.5	10.9	9.7	9.2	14.6	11.2	10.1	8.9	10.9	10.6	6.5-8.5 ^d
Conductivity	umhos/cm 25°C	194	309	183	332	210	363	329	467	154	239	93	235	202	314	
pH	S.U.	7.6	7.4	6.5	7.1	7.2	7.1	7.4	7.2	7.7	7.8	8.8	7.2	7.6	7.3	
Redox Potential	M.V.	+501	+481	+443	+485	+212	+215	+396	+181	+443	+425	+316	+216	+360	+510	
<u>General Chemistry</u>																
Calcium	mg/l	42	41.9	50	46.4	43	48.3	74	60.5	31	29.2	14	32.1	49	42.7	250 ^d
Magnesium	mg/l	11	11.4	12	11.7	12	12.6	16	13.3	9.1	10.5	6.2	9.3	12	11.4	
Potassium	mg/l	1.3	1.4	1.0	1.1	1.7	2.0	4.1	2.3	0.9	0.8	1.5	0.9	1.3	1.4	
Sodium	mg/l	5.5	5.5	3.8	3.7	4.9	5.1	14	11.5	2.6	2.6	5.5	3.4	4.9	5.0	
Chloride	mg/l	ND	2.0	ND	1.5	ND	3.0	4	4.6	ND	0.9	ND	2.3	ND	1.8	250 ^d
Sulfate	mg/l	16	17.8	6	10.5	6	8.6	35	34.6	6	6.9	ND	21.4	13	14.7	
Total Alk as CaCO ₃	mg/l	134	147	163	178	150	201	216	209	108	125	68	98.3	153	162	500 ^d
TDS	mg/l	-	76	-	138	-	183	-	160	-	89	-	92	-	163	
<u>Trace Metals</u>																
Arsenic	µg/l	<2	4.1	3	5.6	31	173	82	101	<2	2.9	<2	9.7	5	7.4	50 ^c
Iron	µg/l	ND	25.6	ND	<22.6	250	1650	60	335	ND	<22.6	ND	884	ND	34.1	300 ^d
Manganese	µg/l	ND	4.2	19	6.1	980	1760	3900	2820	ND	3.2	22	241	11	<1.8	50 ^d
Zinc	µg/l	11	<11.7	50	56.0	9	<11.7	21	<11.7	97	135	66	<11.7	56	40.1	5000 ^d

^a As reported by HLA, June 10-23, 1986.^b Downstream Screening Study, Nov. 1988. (See Figure 3.2-1 for well locations.)^c Primary MCL, Safe Drinking Water Act, 40 CFR Part 141, Subpart B.^d Secondary MCL, Safe Drinking Water Act, 40 CFR Part 141, Subpart B.^e ND = Not Detected

reservoir sediments. The increased values could also be related to analytical variations such as more effective recovery of the analyte from the sample by the laboratory, or related to fluctuations in the water table.

Figure 3.2-5 shows the distribution of arsenic values in the ground water as detected by the Downstream Screening Study. As in the HLA study the existence of an arsenic plume extending from HLA-1 and HLA-2 near the Milltown Reservoir to the west northwest can be inferred, based on slightly elevated values near the intersection of I-90 and the Clark Fork River. However, the existence of an uninterrupted arsenic plume originating from the reservoir sediments and extending to the western portion of the study area cannot be established due to the lack of intermediate sample points.

The HLA investigations also indicated a plume of elevated manganese concentration was closely associated with the distribution of the arsenic. Figure 3.2-6 shows the distribution of manganese in the study area based on the samples collected in the Downstream Screening Study. In comparison with the HLA results the DSS samples exhibited increased manganese levels in five wells and decreased or steady levels in four wells. The concentration of manganese exceeds recommended secondary drinking water standards in three monitoring wells in the Milltown Dam - Blackfoot River area (HLA-1, HLA-2, and M-17). The elevated values also appear to be associated with the lower redox potentials measured in these wells. The sample from Well C-21 also appears to be slightly elevated. Manganese levels over the rest of the study area are more difficult to interpret. At wells OH and A-2, which are only about 50 feet apart, manganese varies from $<1.8 \mu\text{g/l}$ to $3.5 \mu\text{g/l}$, respectively. The marked variation between the manganese concentrations in the monitoring wells and domestic supply wells is curious. It could indicate localized changes in the manganese content due to ground water withdrawal causing localized disturbances in the ground water system such as oxygenation of the ground water near actively producing wells.

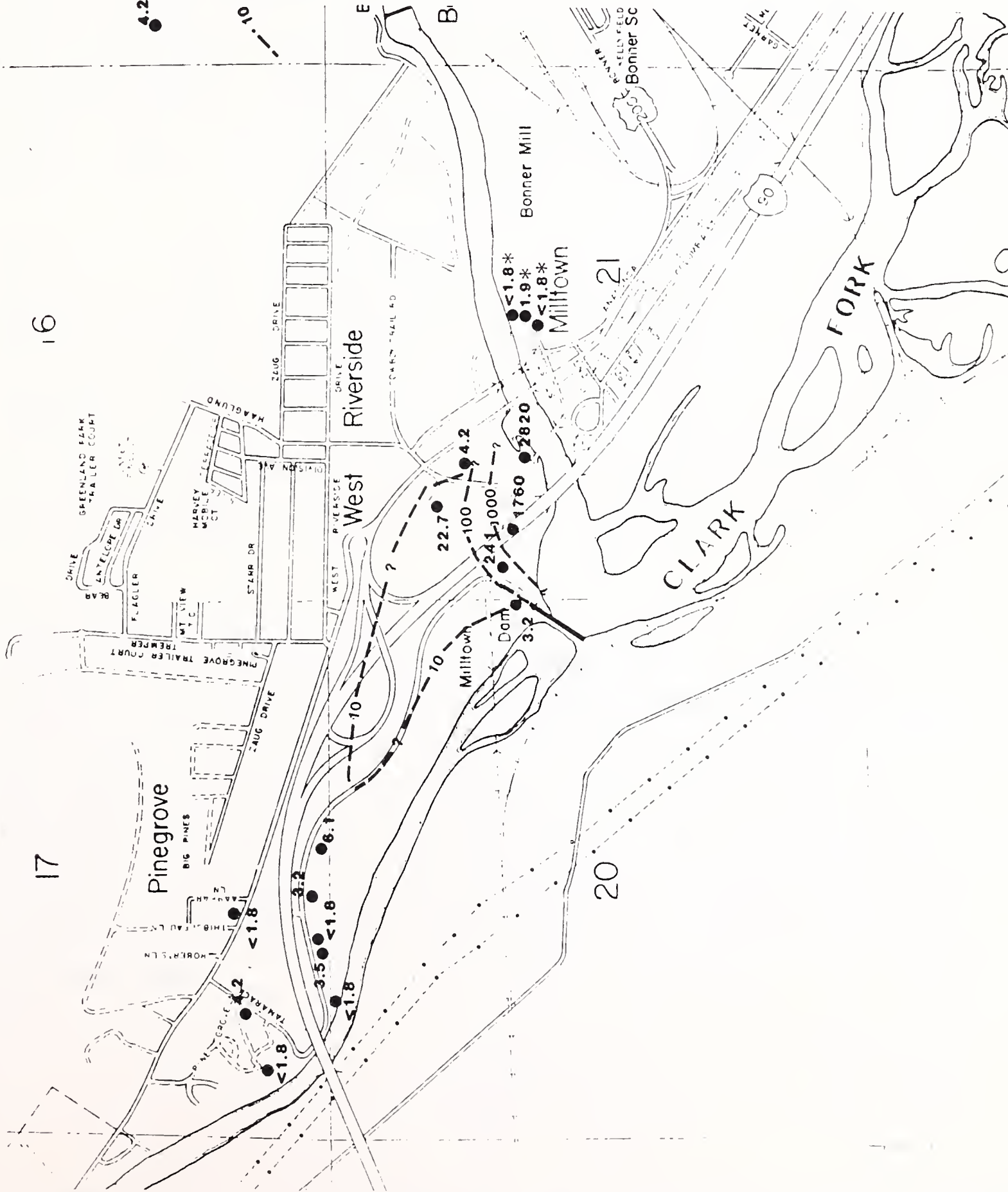
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EXPLANATION

● 4.2 LOCATION OF GROUND WATER SAMPLE
SHOWING CONCENTRATION OF MANGANESE
IN UG/LITER (* = DATA NOT USED TO
DEVELOP CONTOURS)

- - - 10 MANGANESE CONCENTRATION CONTOUR
(LOGARITHMIC CONTOUR INTERVAL,
APPROXIMATELY LOCATED, QUERIED
WHERE INFERRED).



MILLTOWN DOWNSTREAM
SCREENING STUDY

DISTRIBUTION OF MANGANESE IN
GROUND WATER-DOWNSTREAM
SCREENING STUDY

CAMP DRESSER & MCKEE INC

FIGURE

3.2-6

CDM

3.2.4.2 Milltown Community Wells

This portion of the ground water investigations focused upon the ground water quality in the area of Champion International's log storage area and three community supply wells located nearby. The log storage area is sprayed with water from the log pond located at the southern end of the storage area to reduce the potential for fires. Drainage from the storage area returns to the log pond for recycling. Additional water is withdrawn from the nearby Blackfoot River to supplement the supply as needed. In 1975, contamination by tannins and lignins resulted in the replacement of some nearby wells. The concern at this time was to determine the water quality in the log pond and ascertain potential impacts to the ground water wells. Three wells located near the log pond were sampled. All wells are utilized for the community supply on a regular basis.

Table 3.2-5 summarizes the sampling results from each of the three wells and the log pond. Two duplicate sample results from the log pond and Well C2-A are also shown for comparison. Values are presented only for compounds actually detected in the samples (see Section 2.5 for the list of parameters analyzed). Constituents detected in the quality control samples as well as the field samples have been omitted. Complete sample results are shown in Appendix 5.2. For purpose of discussion the maximum value reported for duplicate sample pairs will be utilized.

Samples collected from the log pond show the water to be slightly acidic (pH=6.1) and of the calcium/sodium bicarbonate type. Four organic compounds were detected, one volatile compound (toluene = 130 µg/l) and three semi-volatile compounds (phenol = 170 µg/l, 4-methylphenol = 570 µg/l and benzoic acid 320 µg/l). In addition, 18 tentatively identified semi-volatile compounds were also detected. The log pond samples also exhibited elevated levels of chloride, arsenic, lead, manganese and zinc in comparison to the Blackfoot River (Section 3.1.3). Because the log pond represents the bottom end of a closed system such elevated levels would not be unexpected.

TABLE 3.2-5

SUMMARY OF LOG POND AND COMMUNITY WELL SAMPLE ANALYSIS RESULTS

Parameter	Units	Log Pond	Log Pond Duplicate	Well C2A	Well C2A Duplicate	Well C2B	Well MT-19	Drinking Water Standards
<u>Field Measurements</u>								
Temperature	°C	7.1	-	10.2	-	10.1	9.2	-
pH	S.U.	6.1	-	7.2	-	7.2	7.2	6.5-8.6 ^b
Conductivity	µmhos/cm @ 25°C	296	-	231	-	231	243	-
Redox Potential	M.V.	-	-	+426	-	+441	-	-
<u>General Chemistry</u>								
Calcium	mg/l	26.3	25.8	29.6	30.9	31.2	31.3	-
Magnesium	mg/l	7.9	7.8	9.9	10.0	10.2	10.3	-
Potassium	mg/l	12.7	12.5	1.1	1.1	1.1	1.1	-
Sodium	mg/l	29.4	28.5	3.8	3.8	3.8	3.8	-
Chloride	mg/l	11.2	-	1.4	1.3	1.3	1.2	250 ^a
Sulfate	mg/l	26.3	-	6.3	6.6	6.3	6.6	250 ^b
Bicarbonate	mg/l	109	-	120	121	122	130	-
TDS	mg/l	414	-	159	195	178	178	500 ^b
<u>Volatile Organics^d</u>								
Toluene	µg/l	130	120	<5	<5	<5	<5	-
<u>Semi-Volatile Organics</u>								
Phenol	µg/l	140	170	2	3	3	<10	3,500 ^c
H-methylphenol	µg/l	440	570	<10	<10	<10	<10	-
Benzoic Acid	µg/l	320	360	<50	<50	<50	<50	-

TABLE 3.2-5 (cont.)

SUMMARY OF LOG POND AND COMMUNITY WELL SAMPLE ANALYSIS RESULTS

Parameter	Units	Log Pond	Log Pond Duplicate	Well C2A	Well C2A Duplicate	Well C2B	Well MT-19	Drinking Water Standards
<u>Inorganics</u>								
Aluminum	µg/l	250	250	22.2	18.1	27.9	25.3	-
Arsenic	µg/l	9.8	9.6	2.5	2.7	3.4	2.2	50 ^a
Barium	µg/l	190	193	216	215	216	234	-
Beryllium	µg/l	<0.9	<0.9	<0.9	<0.9	1.1	<0.9	-
Cadmium	µg/l	<3.1	<3.1	10.0	<3.1	<3.1	<3.1	10 ^a
Lead	µg/l	5.2	5.4	1.5	0.9	<0.8	1.2	50 ^a
Manganese	µg/l	664	649	<1.8	<1.8	1.9	<1.8	50 ^b
Zinc	µg/l	124	124	<11.7	<11.7	<11.7	174	5,000 ^b

^a Primary MCL, Safe Drinking Water Act, 40 CFR Part 141, Subpart B.

^b Secondary MCL, Safe Drinking Water Act, 40 CFR Part 141, Subpart B.

^c Clean Water Act, Water Quality Criteria for Human Health, 40 CFR part 131.

^d Acetone, methylene chloride and five additional tentatively identified volatile organic compounds not shown due to presence in quality control samples.

^e Eighteen additional tentatively identified semi-volatile organic compounds reported from 40 to 7,600 µg/l.

The sample results from the community supply wells indicate that the ground water is a calcium bicarbonate type with a near neutral pH (7.2). All of the inorganic constituents are reported to be within drinking water standards except for cadmium in sample C2-A, which is equal to the 10 µg/l primary standard. A separate aliquot from this sample analyzed by the laboratory for quality assurance purposes and a duplicate sample collected in the field did not contain detectable cadmium. This indicates that the cadmium observed in the original sample is probably anomalous and was not distributed throughout the ground water matrix. This could have occurred through a variety of potential cross-contamination sources in the field or laboratory. In addition, zinc also appeared to be elevated in the sample from MT-19 at 174 µg/l, but is still well under the secondary MCL level established. Weathered, galvanized steel piping which connects the pump to the tap where the sample was collected is a likely source of the elevated zinc detected.

Phenol was the only organic constituent detected in the ground water samples. It was detected at 3 µg/l in both wells C2-A and C2-B. It was not detected in the sample from MT-19. Phenol is a common acidic compound produced by decomposition of wood. It is soluble in water and has a specific gravity of 1.07222. It was detected in the log pond at 170 µg/l which could be related to the presence of this compound in the ground water samples. The phenol could also be introduced to the ground water system by direct infiltration at the ground surface, or another as yet unknown source. The 3 µg/l level is well below the water quality criterion for health of 3,500 µg/l established by the Clean Water Act.

3.3 RIVER SEDIMENTS

River sediments were investigated as part of Task 2 of the Downstream Screening Study. Samples were collected to determine the extent to which metal-laden sediment may have been transported downstream of Milltown Reservoir and deposited within the Clark Fork River system between Missoula and the confluence with the Bitterroot River.

3.3.1 PREVIOUS WORK

Previous studies have focused on contaminated sediments upstream of the Milltown site. They show that sediments enriched in metals originating in the Butte-Anaconda mining district were introduced to and deposited within the Clark Fork River system, especially prior to construction of the Warm Springs Ponds. Low floodplain and active channel bed sediments between Warm Springs Ponds and Milltown Reservoir are enriched in trace metals compared to levels found in non-mined tributaries such as the Little Blackfoot River, Rock Creek and the Blackfoot River (Moore, 1985). Enrichment with copper, arsenic, zinc, lead and cadmium, up to 100 times over background, was reported. Metal concentrations tended to decrease, though with high variability, with distance downstream of Warm Springs Ponds.

At the Grant-Kohrs Ranch National Historic Site on the Upper Clark Fork, riparian zone soils show up to two orders of magnitude enrichment of copper, arsenic, and cadmium over aerally deposited background levels on the Blackfoot River (Rice, 1985). Sediments deposited in the floodplain are potential sources of metals to the riverine environment. Phillips (1985) documented a flood event on the upper Clark Fork, trace metal concentrations in the river and in the gills of fish killed during the flood event.

Milltown Reservoir serves as the first impoundment downstream of the Warm Springs Ponds for fluvially transported sediments. Three hydropower water impoundments downstream from Milltown Reservoir also show elevated levels of metals in the reservoir sediments, particularly zinc and cadmium. Transport of contaminated sediments below the Milltown Dam may have occurred during drawdowns or other operational conditions of Milltown Reservoir, during flood events, and prior to dam construction in 1906 (Johns and Moore, 1985).

Increasing trace metal concentrations typically correlate positively with decreasing grain size, increasing sediment surface area, and increasing concentrations of iron and manganese oxides and organic matter (USGS, 1984; Horowitz and Elrick, 1987). To normalize bulk sediment concentrations for lateral comparison of sediment trace metal concentrations, bulk concentrations can be weighted by the percentage of fine grained material or analysis can be completed on small grain size fractions only. In the Clark Fork mainstem, unlike its tributaries, correlation between percent of fine grained sediment (less than 63 microns), and trace metal concentration is weak. Coarse grained fractions from mining processes contribute significantly to bulk metal concentrations (Moore et al., undated; and Brook and Moore, undated). Thus, normalizing bulk concentrations by weighting with the percent of fine grained material gives erroneous results for the Clark Fork River system.

Task 1 of the Downstream Screening Study surveyed the effect of the 1988 reservoir drawdown on sediment transport downstream of Milltown Dam. Task 2 of the Downstream Screening Study provided information on the distribution of metal enriched sediments between Missoula and the confluence of the Clark Fork and the Bitterroot rivers. Previous studies dealing with sediment distribution downstream of Milltown Reservoir found that concentrations of metals, namely copper, lead, arsenic, cadmium and zinc, in fine grained bed sediments had decreased to background values 250 miles below the Warm Springs Ponds or the confluence between the Clark Fork and Flathead rivers. Downstream decreases are thought to be caused by mixing of sediments rich in mill tailings with floodplain sediments on the Clark Fork mainstem having background trace metal concentrations (Andrews, 1987). Two locations sampled by Andrews are within the river section between Milltown Reservoir and the Bitterroot River. Savka (1988) found a similar downstream trend for most metals in channel bed and bank sediments. Sampling locations C11b and C12b correspond to transect number one of the present study.

3.3.2 ANALYSIS RESULTS

Background metal concentrations were obtained from previously published data on the Little Blackfoot, the Blackfoot, and the Bitterroot rivers, Rock Creek, and the Missoula Lake beds and compiled in Table 3.3-1. Previous investigations concentrated on trace metal concentrations within active channel bed or bank sediment deposits as indicated in Table 3.3-1. Background averages from existing literature for fine grained active channel bed sediments, active channel bank, bulk sediments, and fine grained active channel bank sediments are presented in Table 3.3-2. On the average, bulk total metal concentrations were less than or approximately equal to total metals concentrations in the fine grained fraction. In contrast, arsenic concentrations showed enrichment in bulk samples versus the fine grained fraction. Cadmium was undetected in tributary sediments. When possible, background data was compared with data collected from comparable physiographic areas and material sampled during this study.

In the current study, deposited sediments were collected, dry sieved partitioned into two grain size fractions (the fraction less than 63 microns and the fraction between 63 and 2 millimeters) and analyzed for trace metals. Bulk metal concentration and grain size analyses were not completed on samples collected as part of this study. Rather, the emphasis of the Downstream Screening Study was to locate areas of metal enrichment in bed and floodplain sediments. Metal concentrations in the <63 micron fraction were utilized for comparative purposes. The <63 micron and the >63 micron fraction between 63 and 200 microns will be referred to as the fine grained and coarse grained fractions, respectively.

Summary statistics for concentrations of seven trace metals in sediments collected during the Downstream Screening Study are presented in Table 3.3-3. Box plots, Figures 3.3-1 to 3.3-7, for each metal provide a comparison of the four physiographic areas and the two grain size fractions. The box plot is a graphic representation of descriptive

TABLE 3.3-1

TRIBUTARY TRACE METAL CONCENTRATIONS^a

Tributary	Total Arsenic	Total Cadmium	Total Iron	Total Lead	Total Zinc	Total Copper	Total Manganese	Physiographic Area	Fraction Analyzed	Source
Little Blackfoot	38.7	Undetected	17,865	20.7	102	34.7	470	Active Channel Bank	Bulk	Moore 1985
Missoula Lake Beds	21.3	-	15,667	16.5	66.5	25.8	506	Active Channel Bank	Bulk	Moore 1985
Rock Creek	9.5	-	8,868	7.3	16.2	10.2	174	Active Channel Bank	Bulk	Moore 1985
Bitterroot	-	Undetected	18,400	-	57.6	19.4	463	Active Channel Bank	<63 μ m	Savka 1988
Little Blackfoot	3.2	0.7	32,000	31.0	153	25.0	1,100	Active Channel Bed	<63 μ m	Andrews 1987
Bitterroot	3.0	<0.5	27,000	24.0	80.0	30.0	400	Active Channel Bed	<63 μ m	Andrews 1987
Bitterroot	-	Undetected	18,400	-	45.7	16.7	288	Active Channel Bed	<63 μ m	Savka 1988
Rock Creek	5.4	<0.5	17,000	6	38	10	200	Active Channel Bed	<63 μ m	Andrews 1987
Blackfoot	4.8	<0.5	26,000	9	54	19	406	Active Channel Bed	<63 μ m	Andrews 1987

^a All concentrations in mg/kg.

TABLE 3.3-2

AVERAGE TRIBUTARY TRACE METAL CONCENTRATIONS^a

Physiographic Area	Fraction Analyzed	n ^b	Total Arsenic	Total Cadmium	Total Iron	Total Lead	Total Zinc	Total Copper	Total Manganese
Active Channel Bank	Bulk	3	23.2	Undetected	14,133	14.8	61.6	23.5	383
Active Channel Bank	<63 μ m	1	-	Undetected	18,400	-	57.6	19.4	463
Active Channel Bed	<63 μ m	5	4.1	Undetected <0.5	24,080	17.5	74.1	20.1	480

^a All concentrations in mg/kg

^b Number of samples

TABLE 3.3-3

DESCRIPTIVE STATISTICS FOR CLARK FORK SEDIMENT SAMPLES
COLLECTED BETWEEN MISSOULA AND THE CONFLUENCE WITH THE BITTERROOT RIVER^a

Physiographic Area	Total Arsenic	Total ^b Cadmium	Total Copper	Total Lead	Total Iron	Total Manganese	Total Zinc
<u>Active Bed</u>							
<u><63µm</u>							
Mean	23.1	3.2	271.0	50.7	11,725	1,145	645
Std. Dev.	6.2	1.0	88.1	10.1	1,798	703	144
Max.	33.6	5.0	360.0	61.2	14,200	2,570	775
Min.	8.3	1.1	61.5	23.0	8,740	362	231
<u>>63µm <200µm</u>							
Mean	8.9	1.0 ^b	86.4	20.0	8,066	389	270
Std. Dev.	7.7	0.96	96.1	14.5	1,918	529	171
Max.	33.1	4.0	377	65.3	13,700	2,060	799
Min.	4.6	0.59	31.5	10.9	6,380	107	172
<u>Slack Water</u>							
<u><63µm</u>							
Mean	23.6	3.4	306	51.5	11,671	756	719
Std. Dev.	7.6	1.4	123	16.2	2,881	253	200
Max.	33.1	6.2	508	80.3	15,000	1,220	1,140
Min.	11.2	1.4	123	24.4	6,980	466	428

TABLE 3.3-3 (cont.)

DESCRIPTIVE STATISTICS FOR CLARK FORK SEDIMENT SAMPLES
COLLECTED BETWEEN MISSOULA AND THE CONFLUENCE WITH THE BITTERROOT RIVER^a

Physiographic Area	Total Arsenic	Total ^b Cadmium	Total Copper	Total Lead	Total Iron	Total Manganese	Total Zinc
<u>>63µm <200µm</u>							
Mean	9.8	1.2 ^b	122	30.9	8,778	273	356
Std. Dev.	6.0	0.6	113	20.9	2,497	167	204
Max.	21.5	2.3	354	65.7	13,600	579	816
Min.	4.9	0.6	32.4	11.2	6,090	133	185
<u>Low Floodplain</u>							
<u><63µm</u>							
Mean	21.7	2.1	174	41.1	13,150	768	623
Std. Dev.	10.3	1.0	95	12.8	1,187	325	473
Max.	37.7	3.4	318	58.1	14,400	1,150	1,180
Min.	8.9	0.7	30	18.4	11,100	326	67.8
<u>>63µm <200µm</u>							
Mean	17.1	1.7 ^b	141	33.5	11,066	578	480
Std. Dev.	6.3	0.62	62.9	12.5	1,578	214	290
Max.	24.8	2.5	212	54.9	12,900	847	832
Min.	9.0	0.62	42.6	19.9	8,540	226	78.8

TABLE 3.3-3 (cont.)

DESCRIPTIVE STATISTICS FOR CLARK FORK SEDIMENT SAMPLES
COLLECTED BETWEEN MISSOULA AND THE CONFLUENCE WITH THE BITTERROOT RIVER^a

Physiographic Area	Total Arsenic	Total ^b Cadmium	Total Copper	Total Lead	Total Iron	Total Manganese	Total Zinc
<u>High Floodplain</u>							
<63µm							
Mean	18.0	1.16 ^b	109	26.3	14,685	519	204
Std. Dev.	20.7	0.60	133	15.5	1,468	228	205
Max.	61.7	2.2	381	45.9	17,100	989	614
Min.	4.7	0.63	14.7	11.2	13,500	353	55.7
>63µm <200µm							
Mean	9.1	0.72 ^b	88.4	17.2	12,257	353	88.8
Std. Dev.	7.0	0.26	127	11.8	2,403	108	63.6
Max.	24.6	1.3	369	39.5	16,200	500	186
Min.	5.3	0.59	12.2	7.4	9,800	215	39.8

^a All concentrations in mg/kg.^b Undetected values treated as missing values.

Figure 3.3-1
**STATISTICAL RANGES OF ARSENIC
 CONCENTRATIONS IN RIVER
 SEDIMENTS**

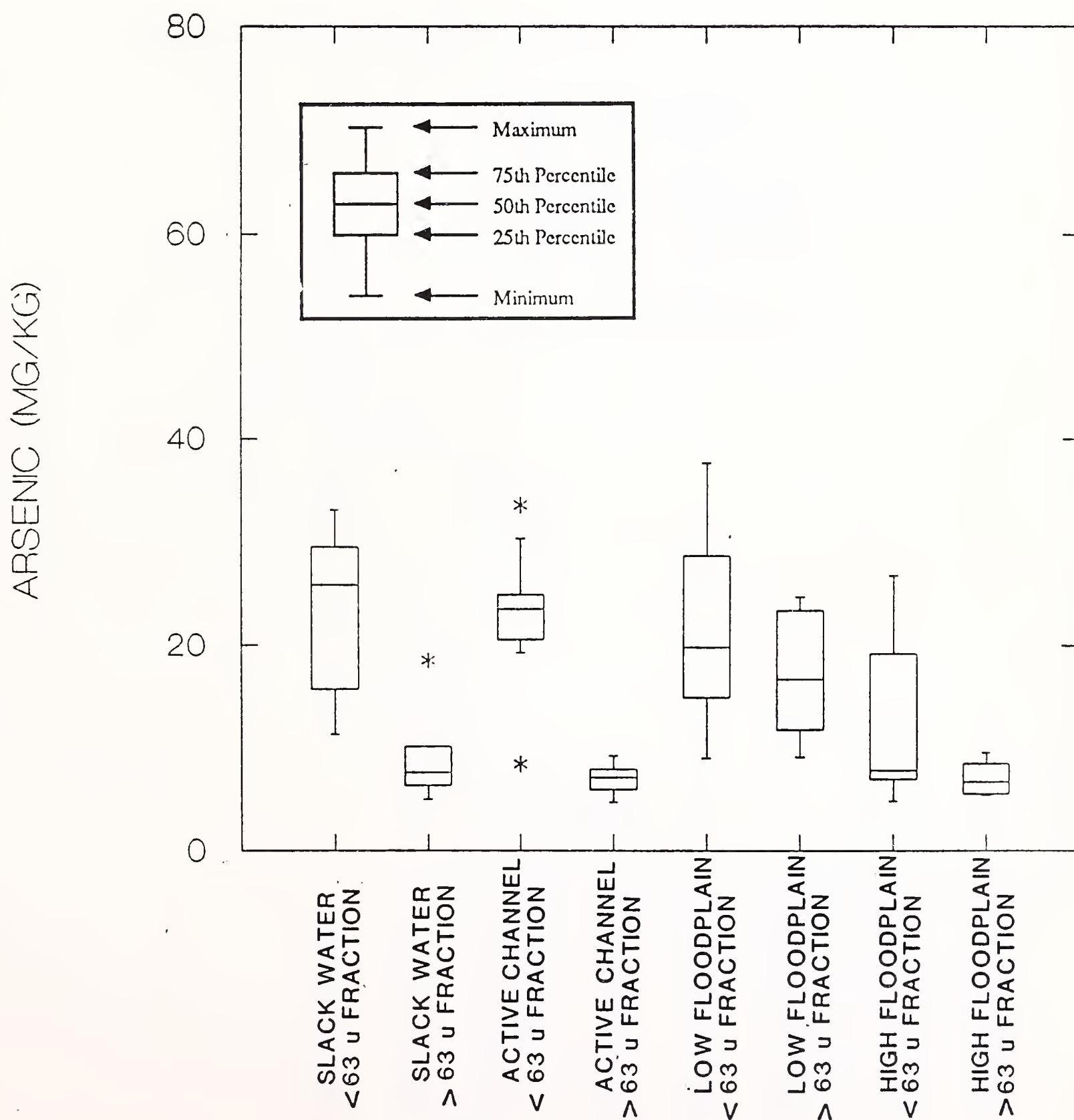


Figure 3.3-2
**STATISTICAL RANGES OF CADMIUM
 CONCENTRATIONS IN RIVER
 SEDIMENTS**

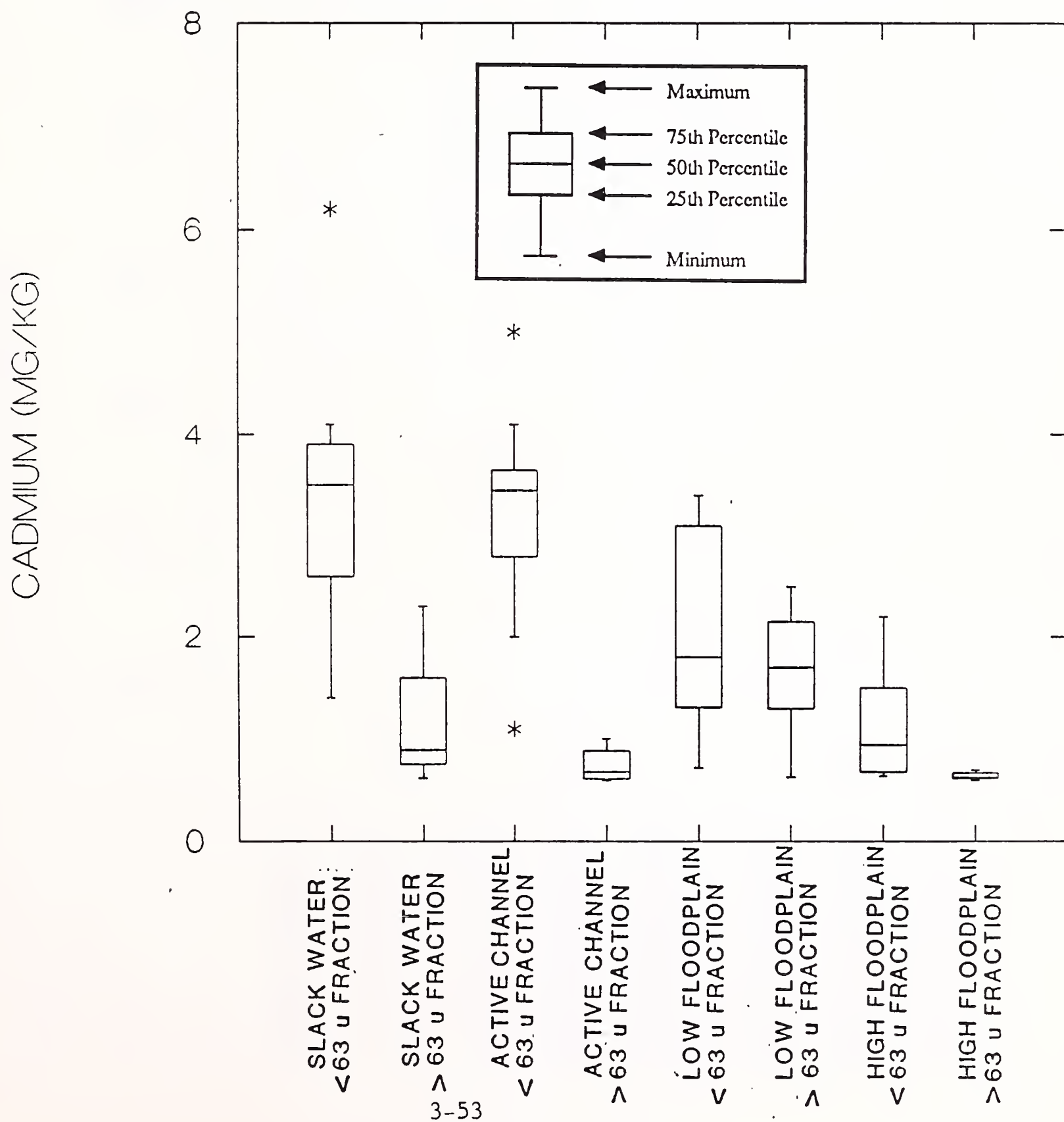


Figure 3.3-3

STATISTICAL RANGES OF COPPER CONCENTRATIONS IN RIVER SEDIMENTS

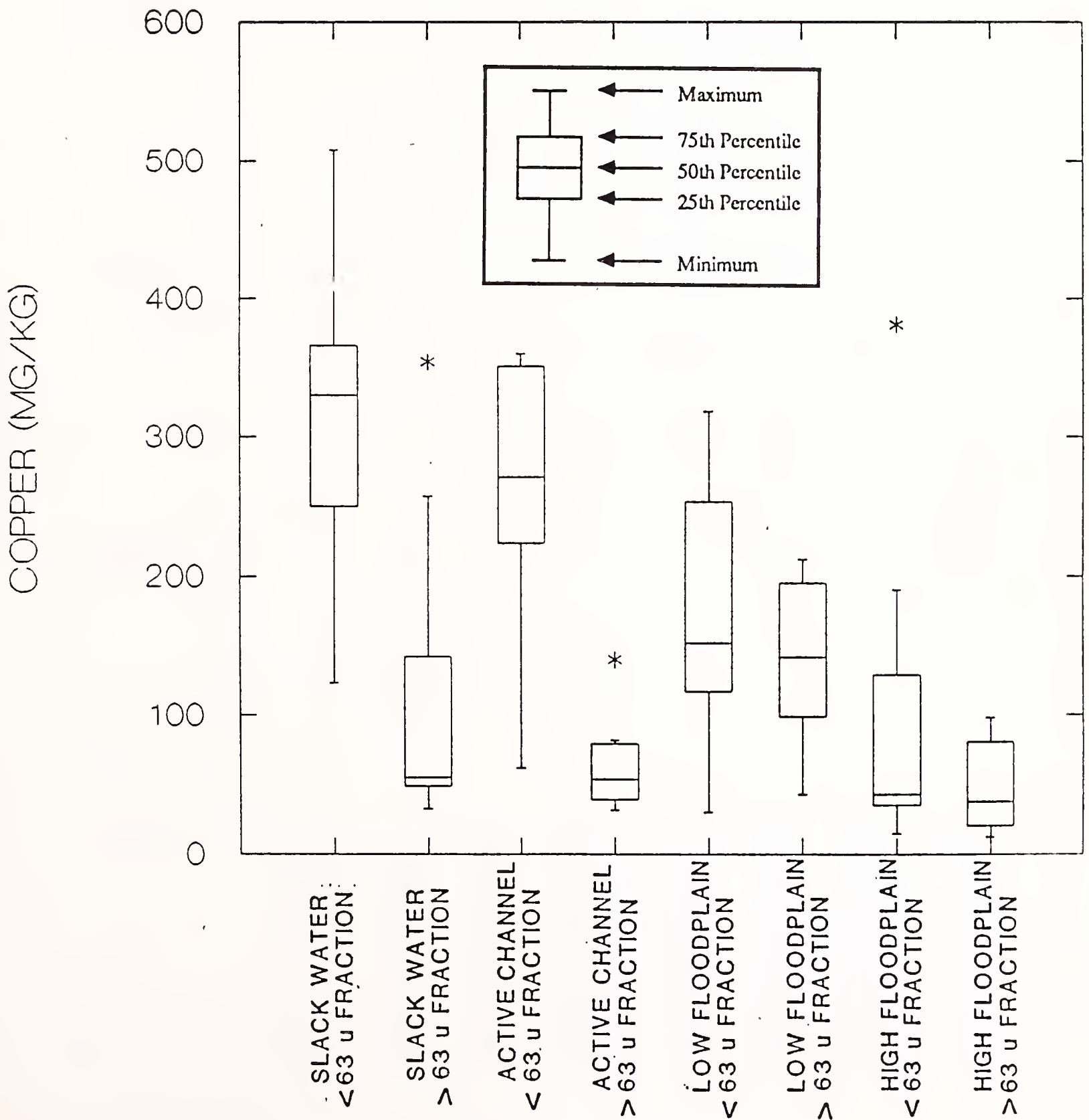


Figure 3.3-4

STATISTICAL RANGES OF IRON CONCENTRATIONS IN RIVER SEDIMENTS

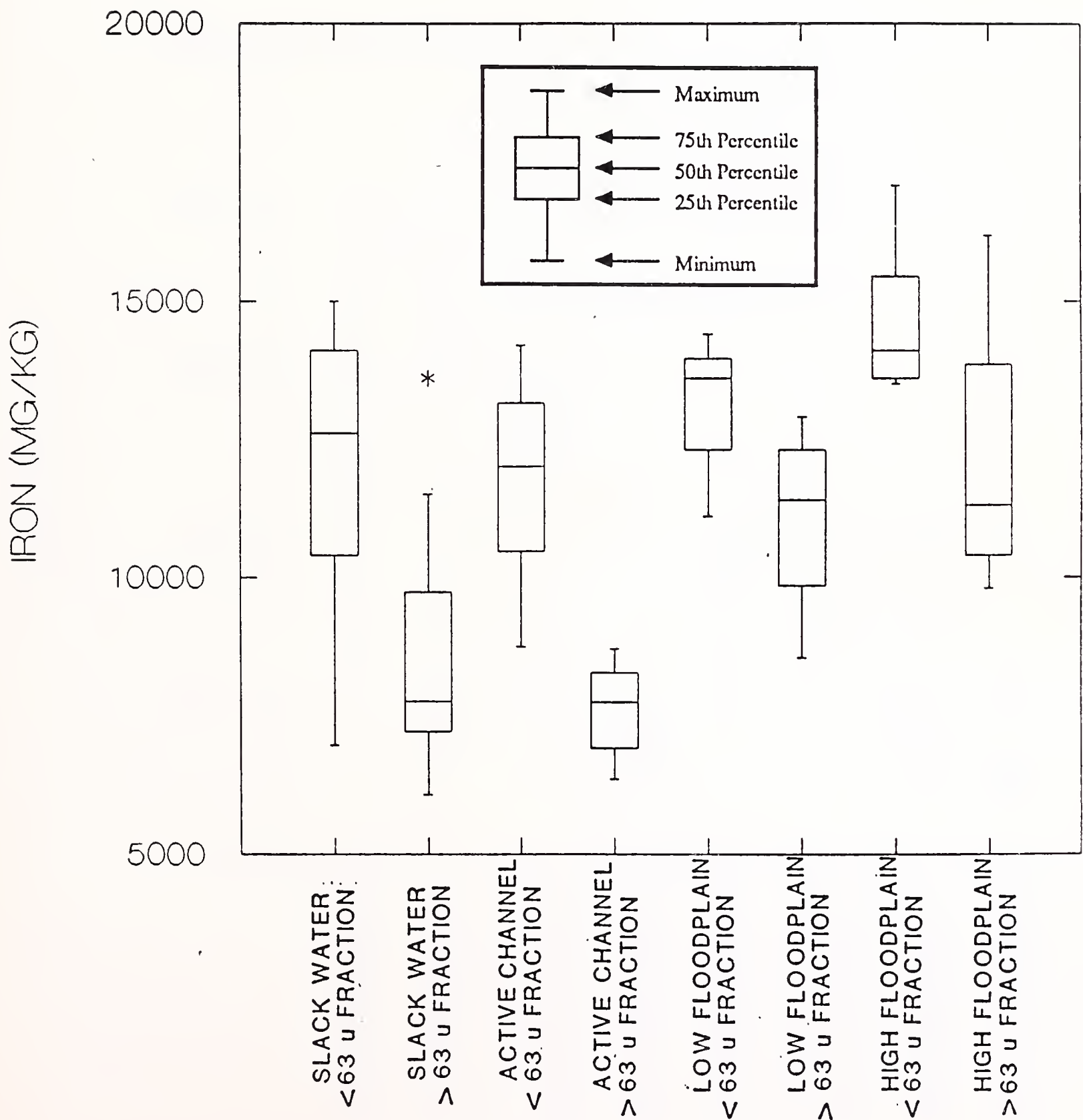


Figure 3.3-5

STATISTICAL RANGES OF LEAD CONCENTRATIONS IN RIVER SEDIMENTS

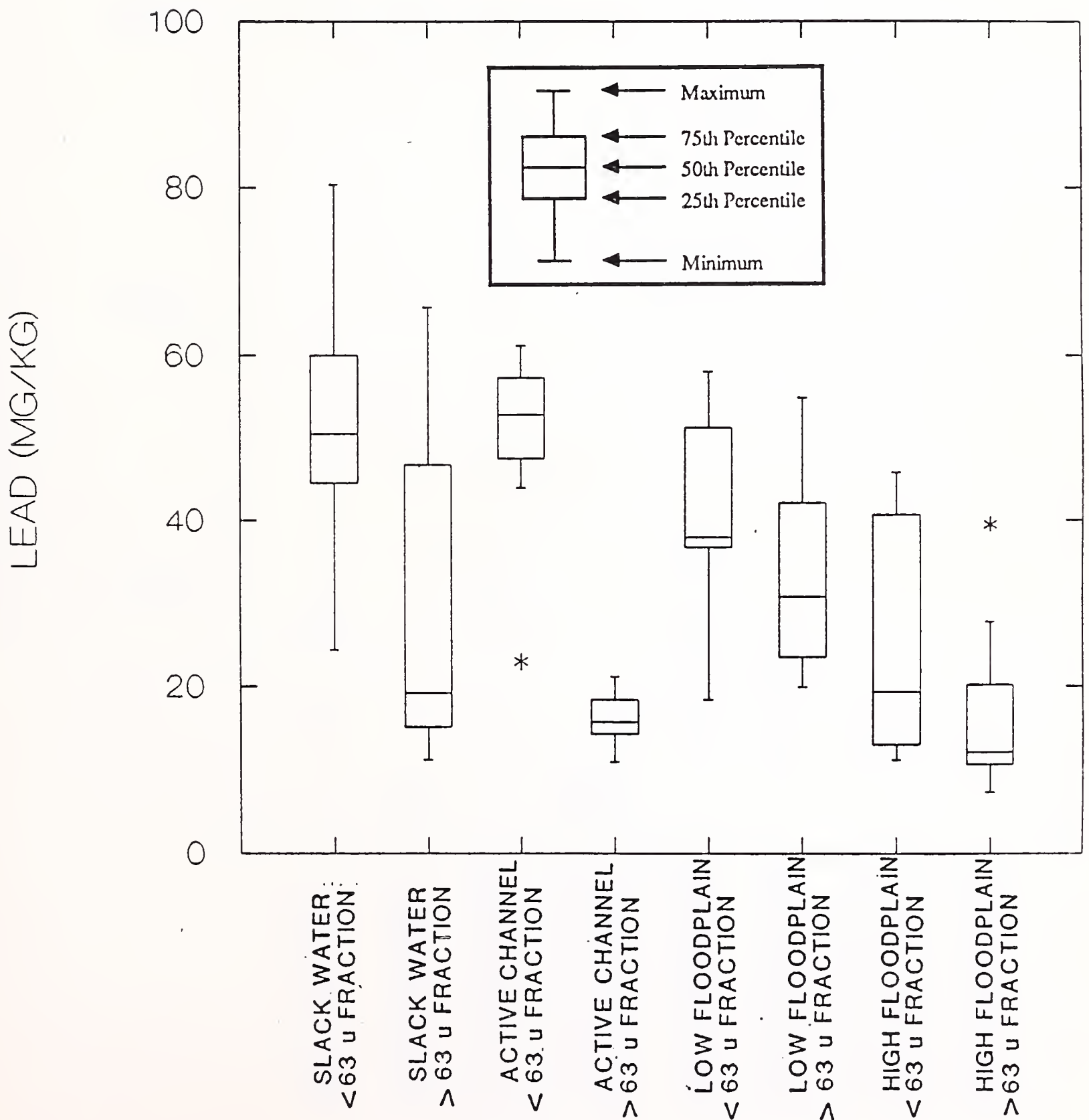


Figure 3.3-6

STATISTICAL RANGES OF MANGANESE CONCENTRATIONS IN RIVER SEDIMENTS

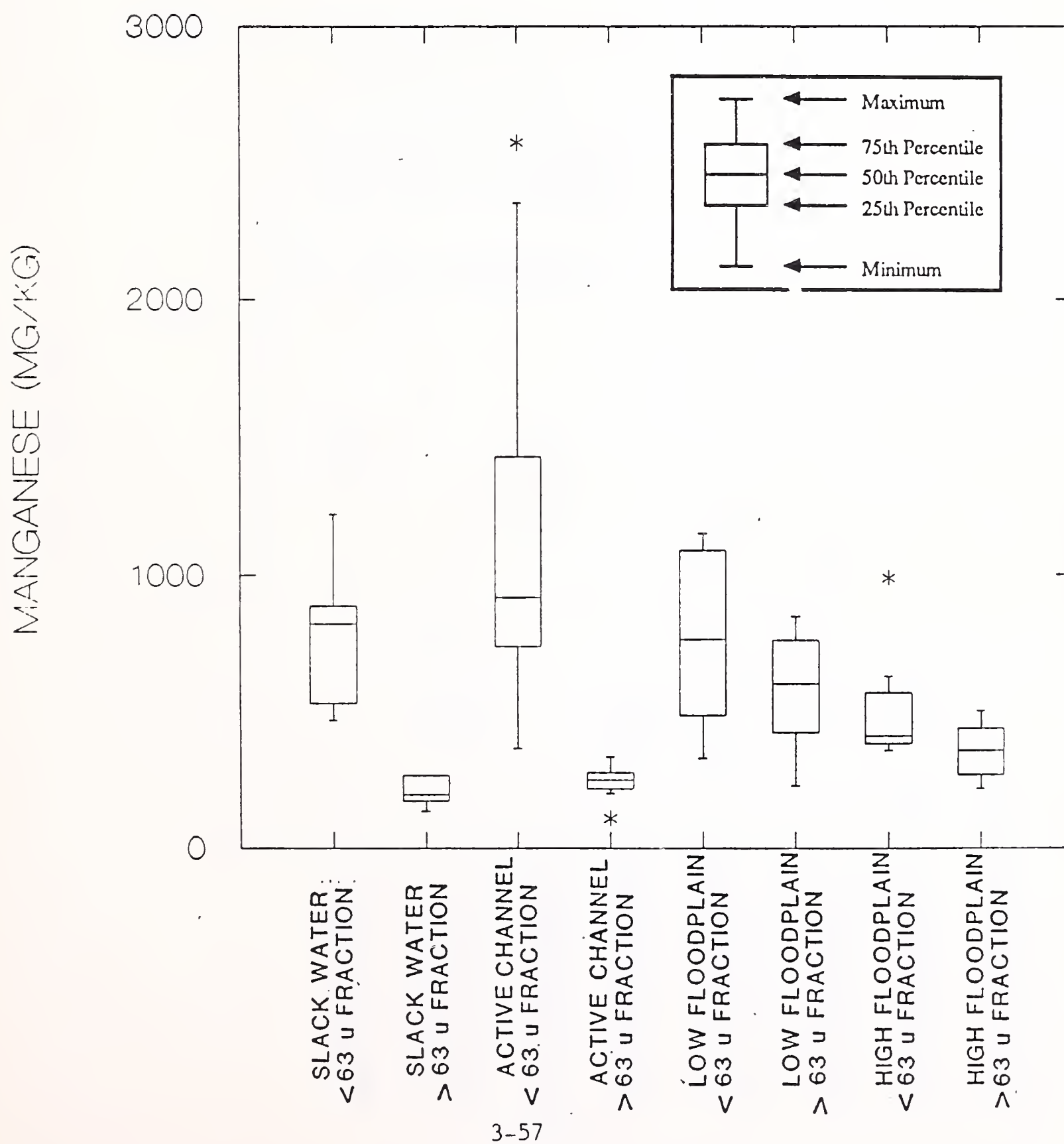
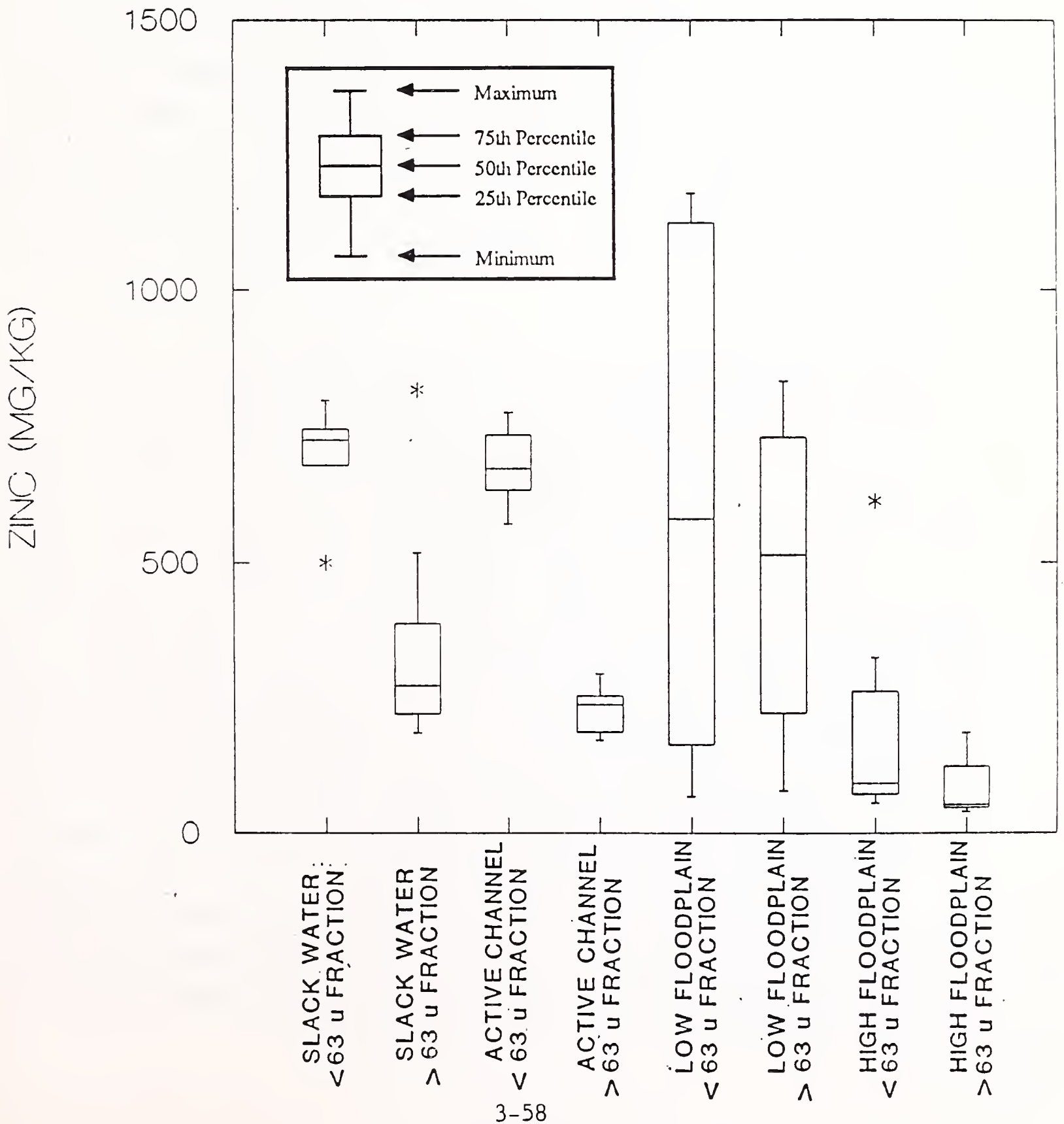


Figure 3.3-7

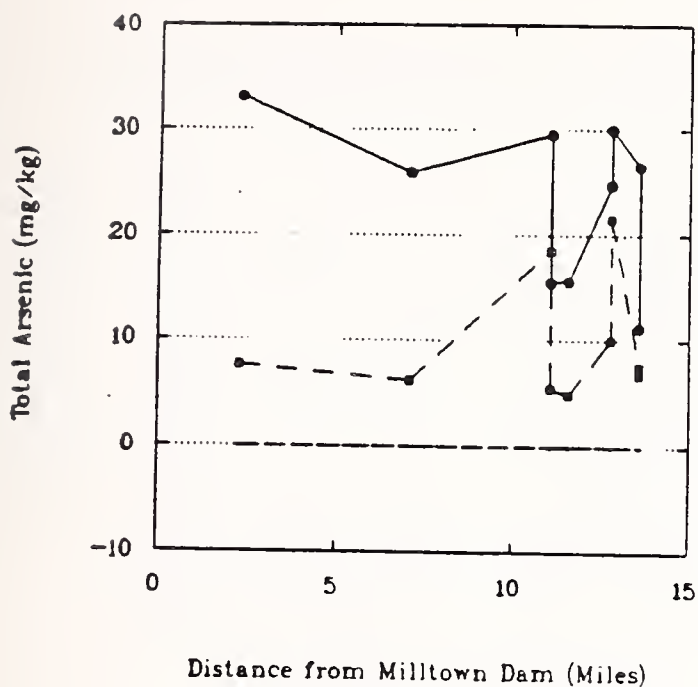
STATISTICAL RANGES OF ZINC CONCENTRATIONS IN RIVER SEDIMENTS



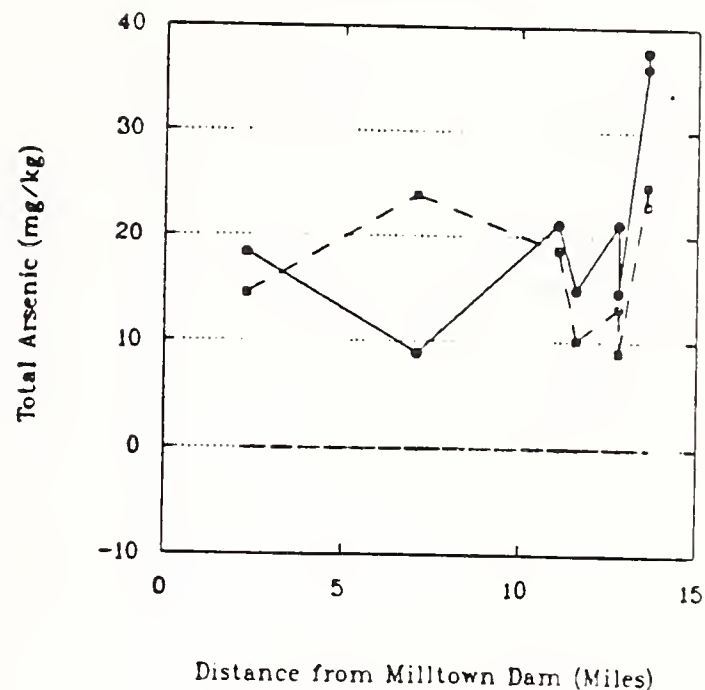
statistics for a designated class of samples. The extremities of each plot represent the maximum and minimum values. The box itself illustrates from top to bottom the 75th, 50th (median) and 25th percentiles respectively, as indicated by the insert in each plot. Mean metal concentrations of fine grained material are greater than coarse grained material for all metals and physiographic areas. Except for iron, fine grained metals concentrations in slack water and active channel bed sediments were higher than low and high floodplain sediments. Standard deviations and ranges are high for all seven metals, but particularly for zinc and copper. Cadmium had several undetected values in the coarse grained fraction which were treated as missing values in statistical analysis. Normal probability plots of metals concentrations separated according to grain size and physiographic area indicate that the data are not normally distributed. Log transformations of fine grained metals concentrations improved the normality of the data such that parametric tests of differences could be used as described below.

Total metals concentrations for each of the four physiographic areas and both the fine grained and coarse grained fractions were plotted against distance downstream of Milltown Dam as shown in Figures 3.3-8 to 3.3-14. Background levels taken from previous data are also shown. Transects in which one physiographic area was sampled twice contain two values plotted against distance and give a visual representation of the spatial variability in sediment concentrations. Spatial variation is particularly high in slack water and active channel sediments for copper, manganese and lead. Regression analysis was performed between these repeat samples. The regression slope was tested for unity using a T-Test and the significance of variability between samples versus within samples was tested using an analysis of variance F-Test. Repeat samples were significantly correlated with each other for arsenic, cadmium and zinc and the regression slope accepted as one with a 97.5 percent degree of confidence. Highest variability between repeat samples was found for iron and manganese, while variability between samples was also high for copper and lead. Spatial variation in metal concentrations was high for iron, manganese, copper and

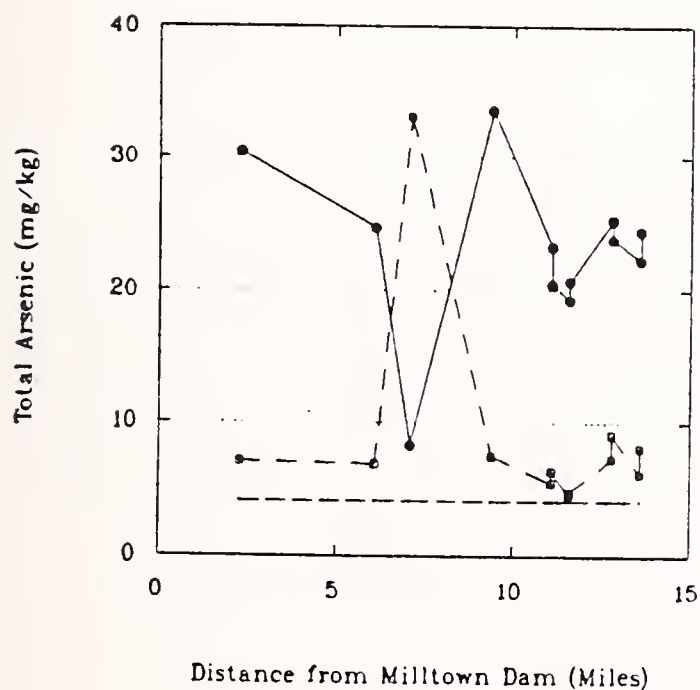
Total Arsenic: Slack Water



Total Arsenic: Low Floodplain



Total Arsenic: Active Channel



Total Arsenic: High Floodplain

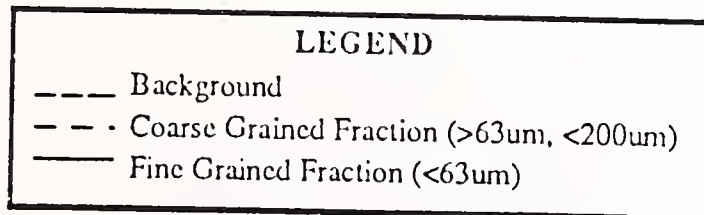
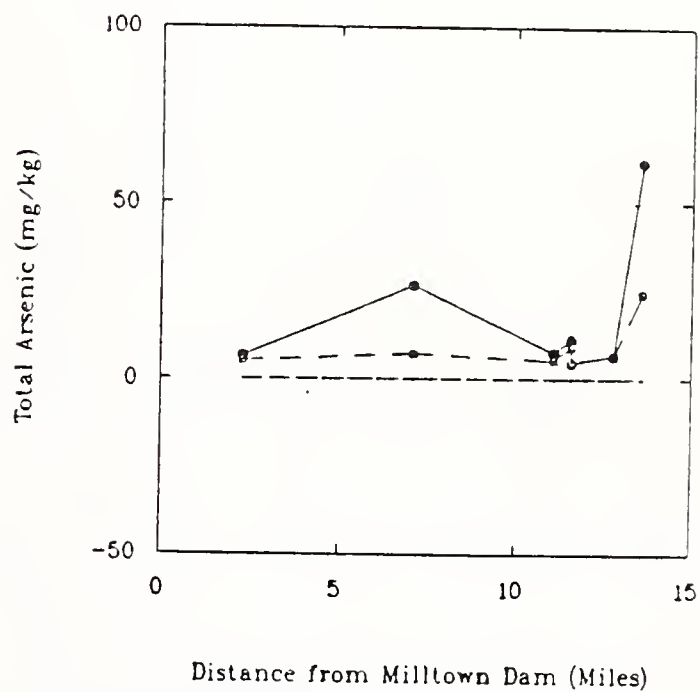
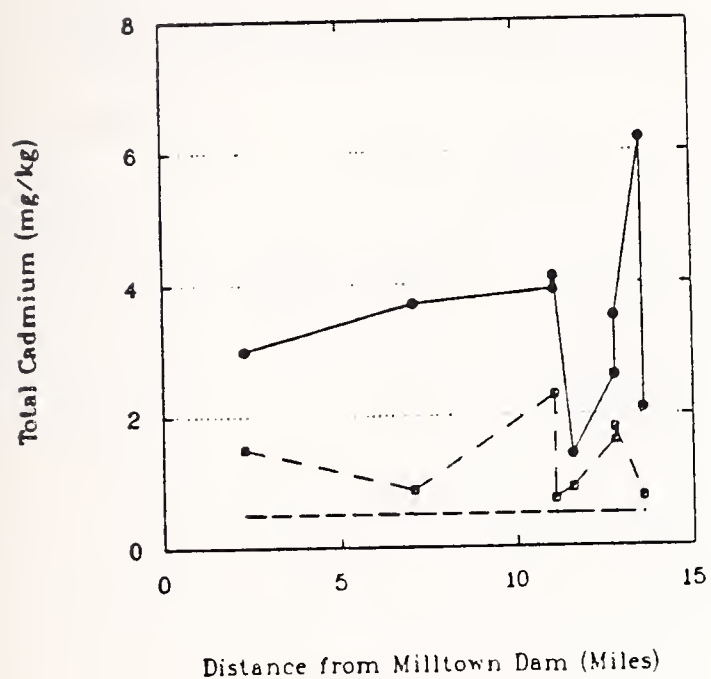
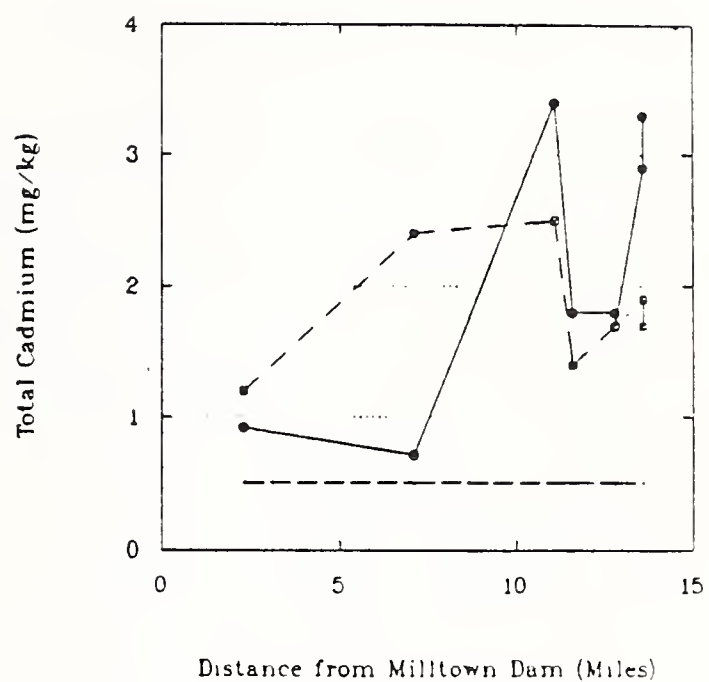


Figure 3.3-8 Total Arsenic Concentration vs Distance Downstream of Milltown Dam

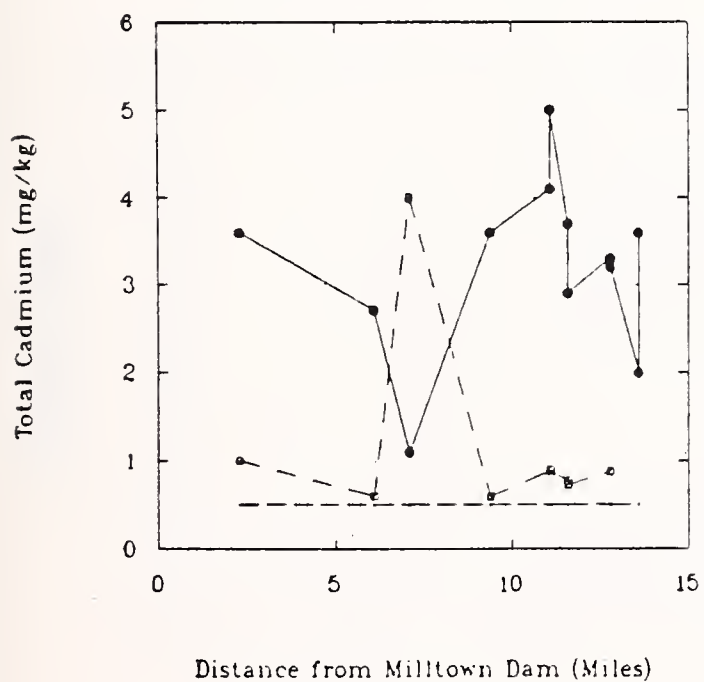
Total Cadmium: Slack Water



Total Cadmium: Low Floodplain



Total Cadmium: Active Channel



Total Cadmium: High Floodplain

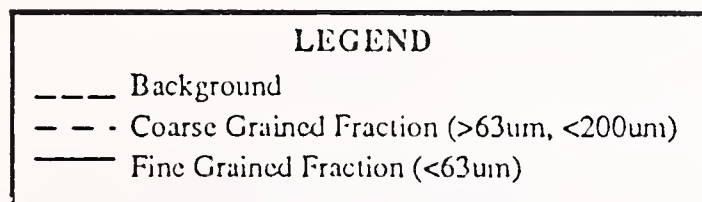
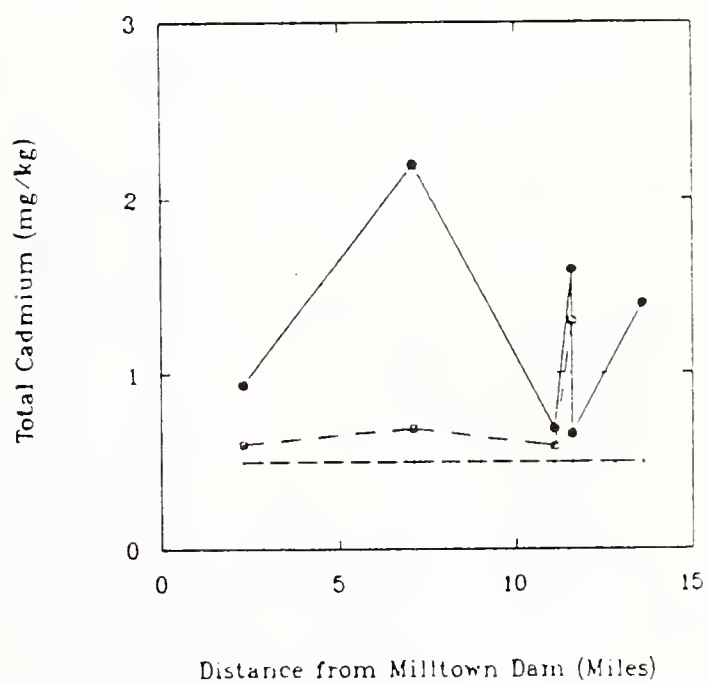
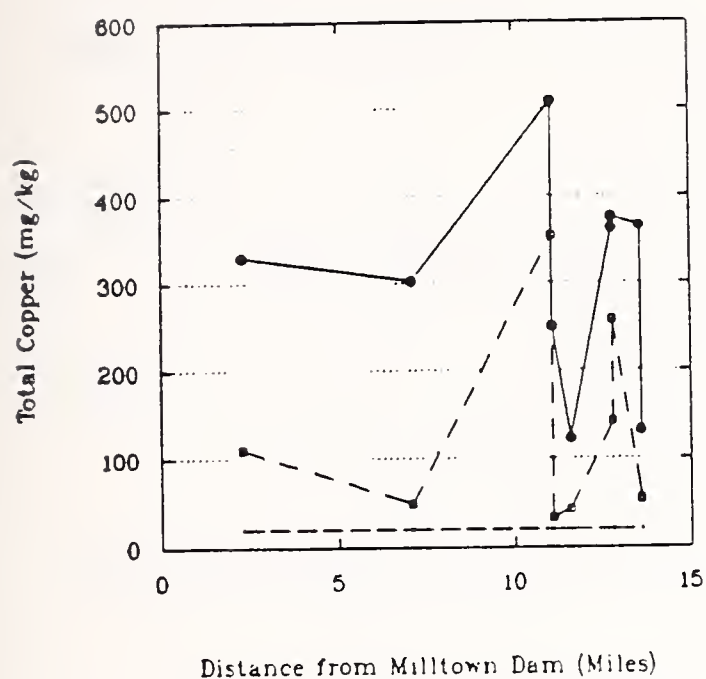
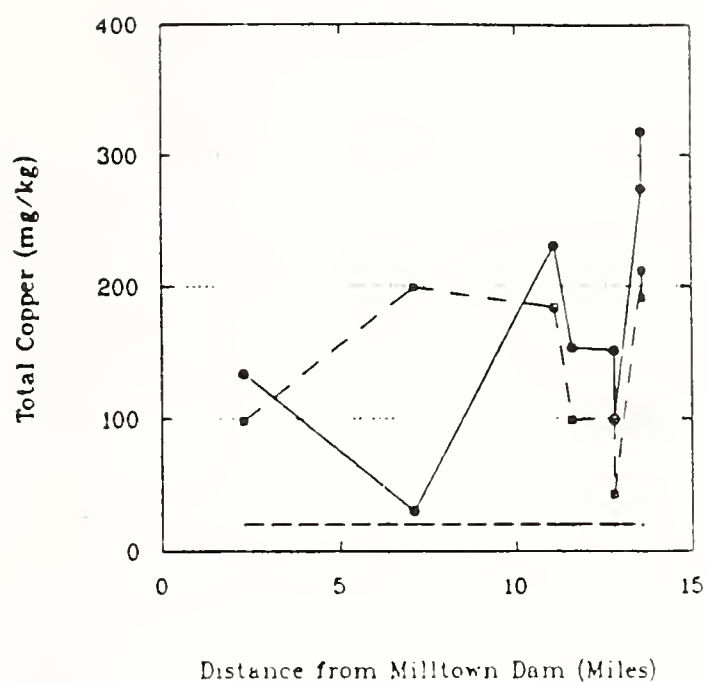


Figure 3.3-9 Total Cadmium Concentration vs Distance
Downstream of Milltown Dam

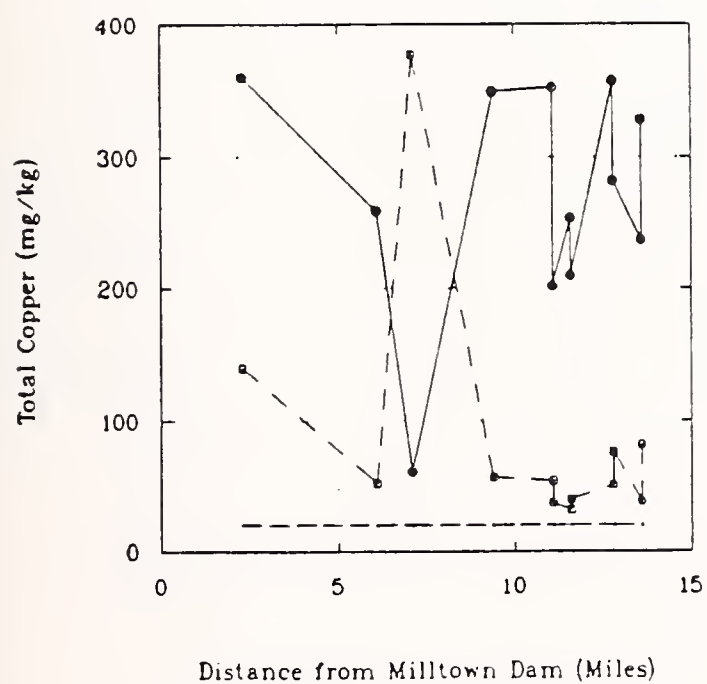
Total Copper: Slack Water



Total Copper: Low Floodplain



Total Copper: Active Channel



Total Copper: High Floodplain

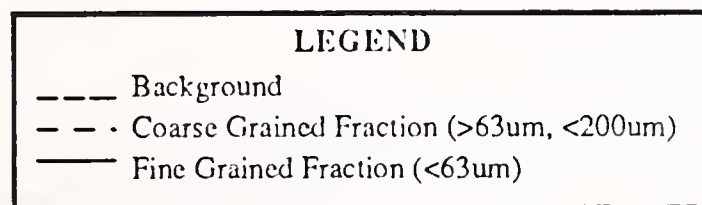
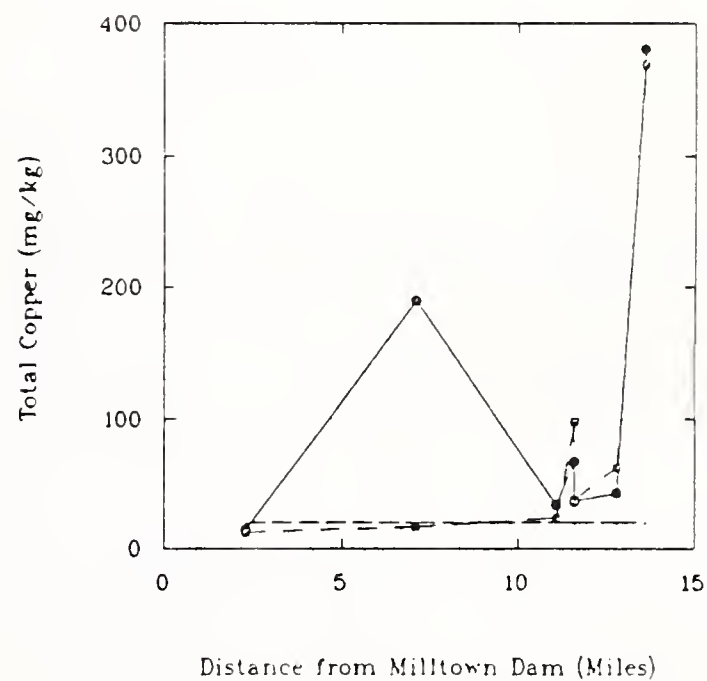
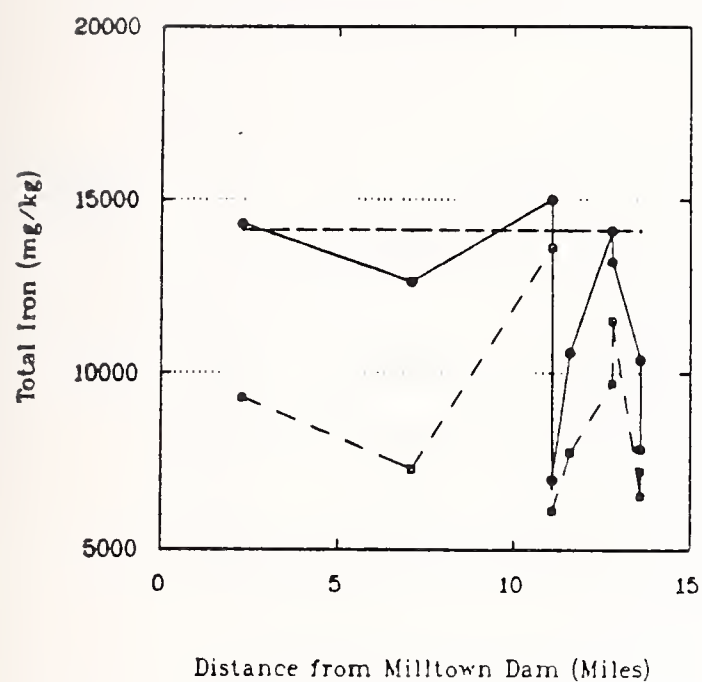
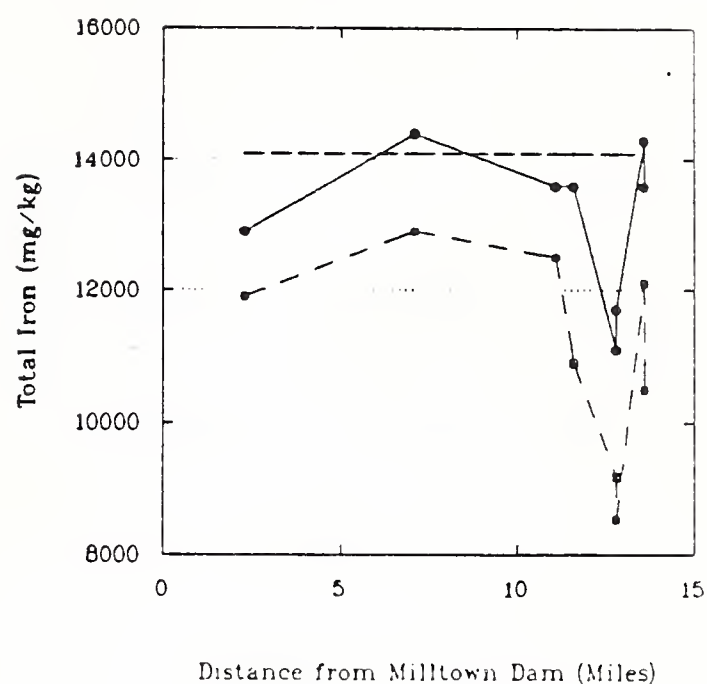


Figure 3.3-10 Total Copper Concentration vs Distance Downstream of Milltown Dam

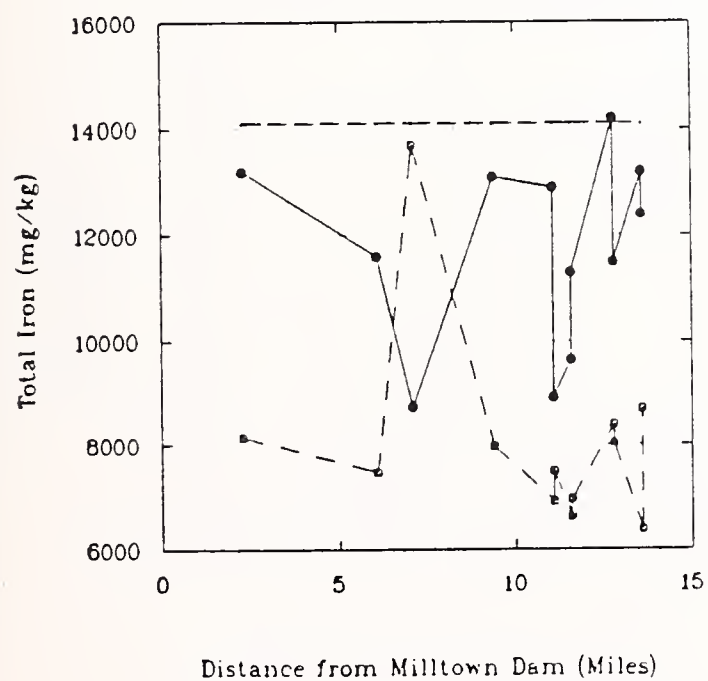
Total Iron: Slack Water



Total Iron: Low Floodplain



Total Iron: Active Channel



Total Iron: High Floodplain

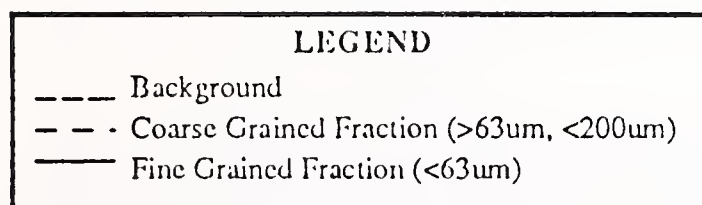
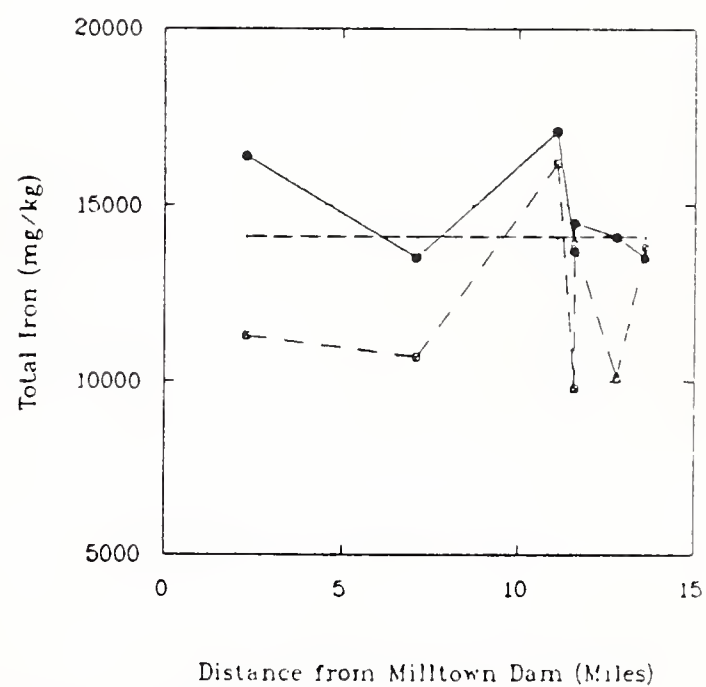
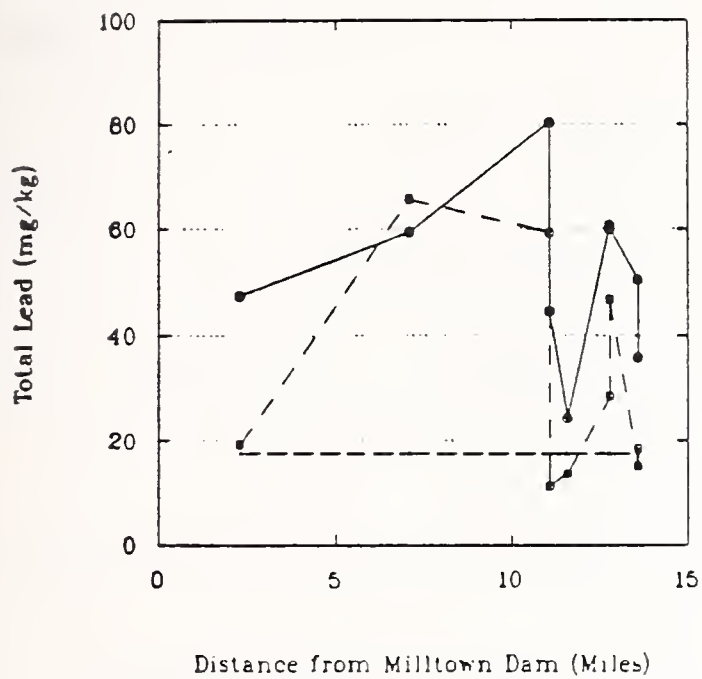
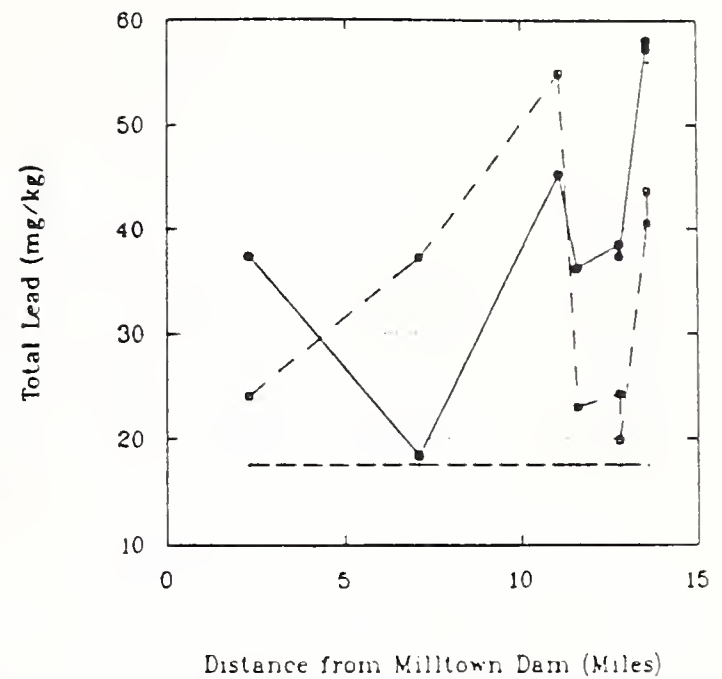


Figure 3.3-11 Total Iron Concentration vs Distance
Downstream of Milltown Dam

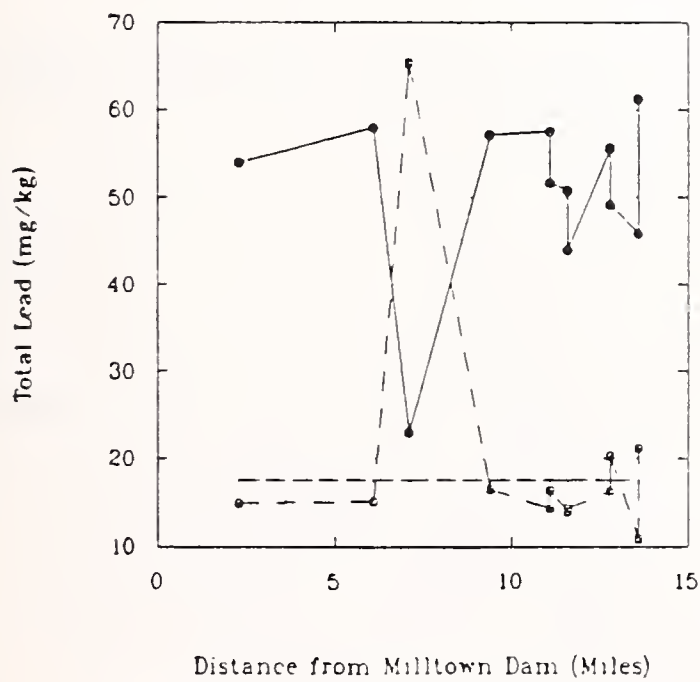
Total Lead : Slack Water



Total Lead : Low Floodplain



Total Lead : Active Channel



Total Lead : High Floodplain

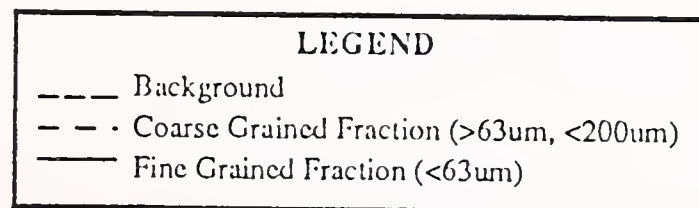
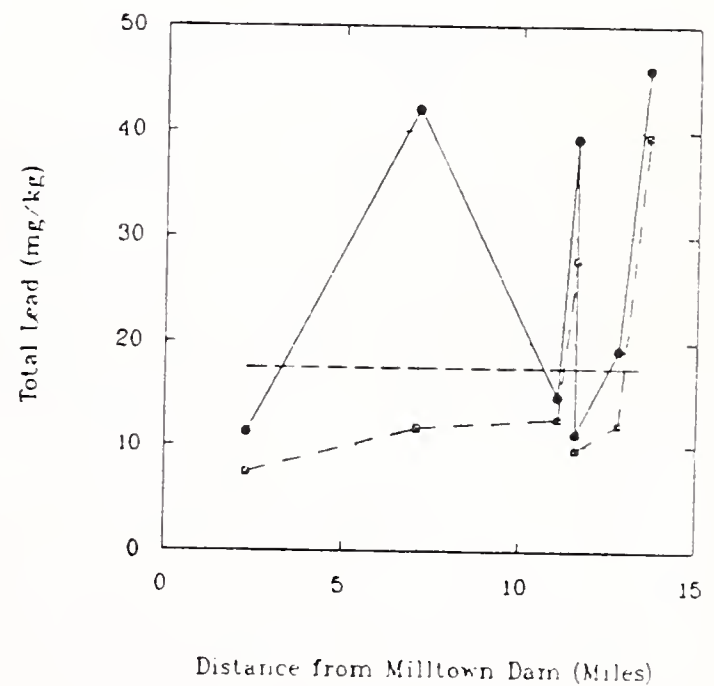
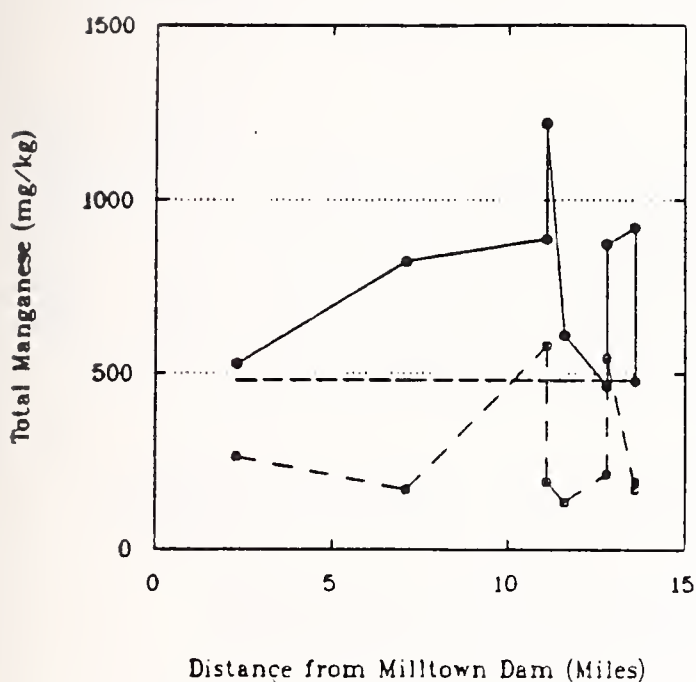
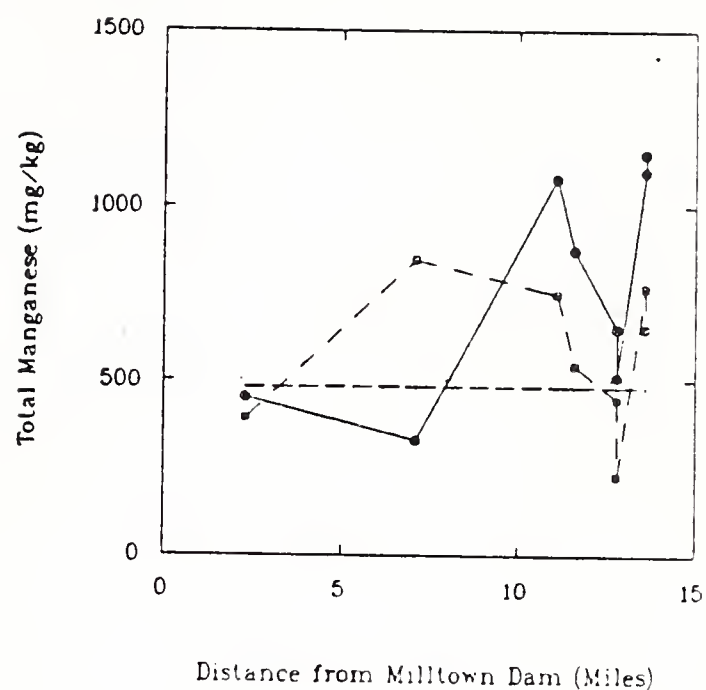


Figure 3.3-12 Total Lead Concentration vs Distance
Downstream of Milltown Dam

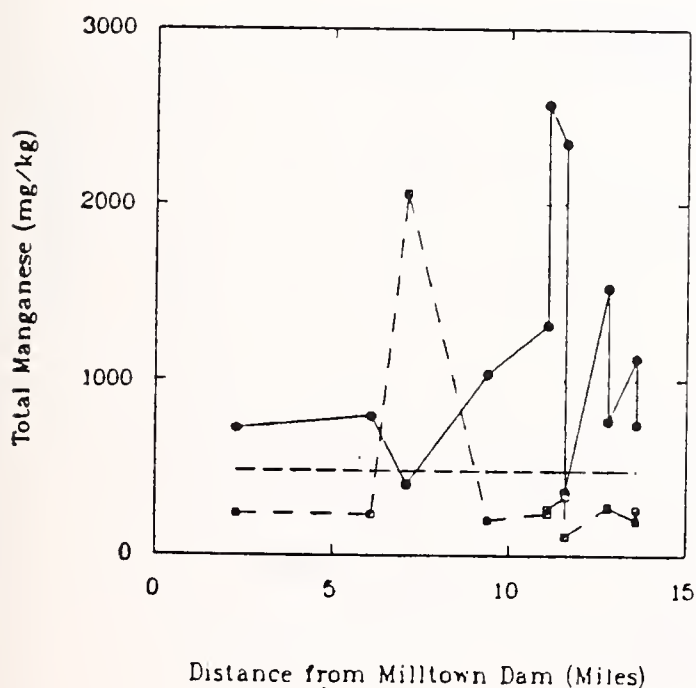
Total Manganese : Slack Water



Total Manganese : Low Floodplain



Total Manganese : Active Channel



Total Manganese : High Floodplain

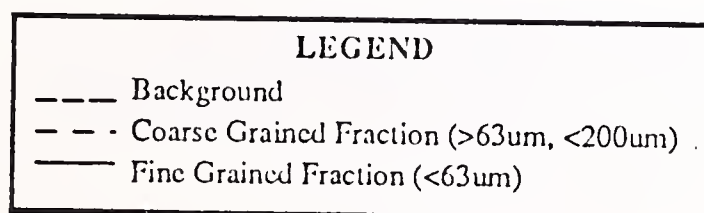
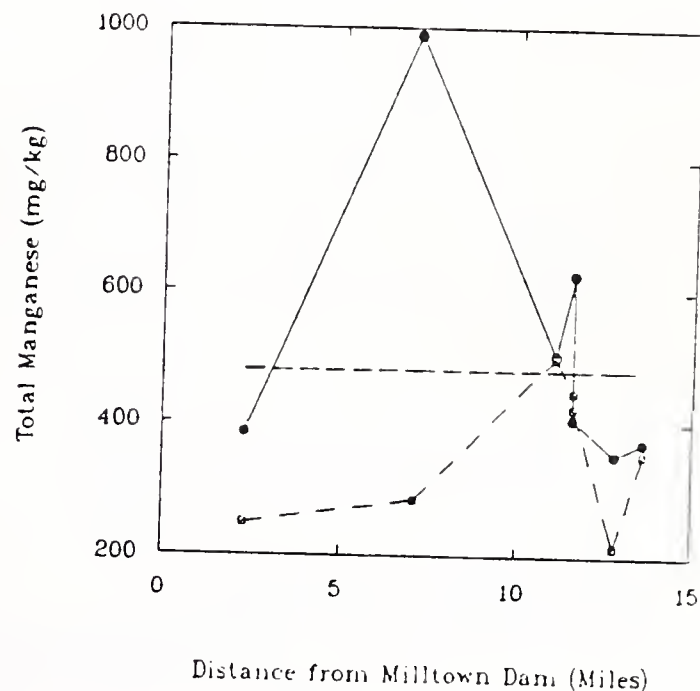
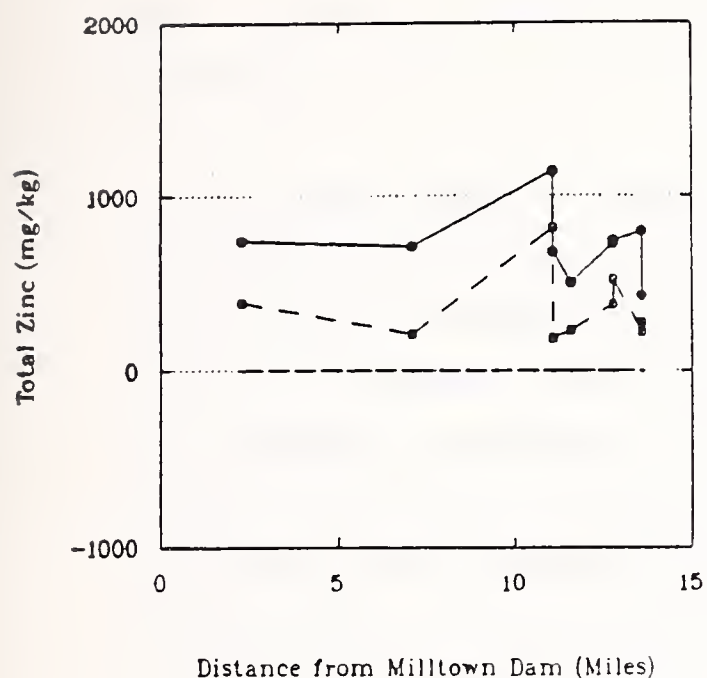
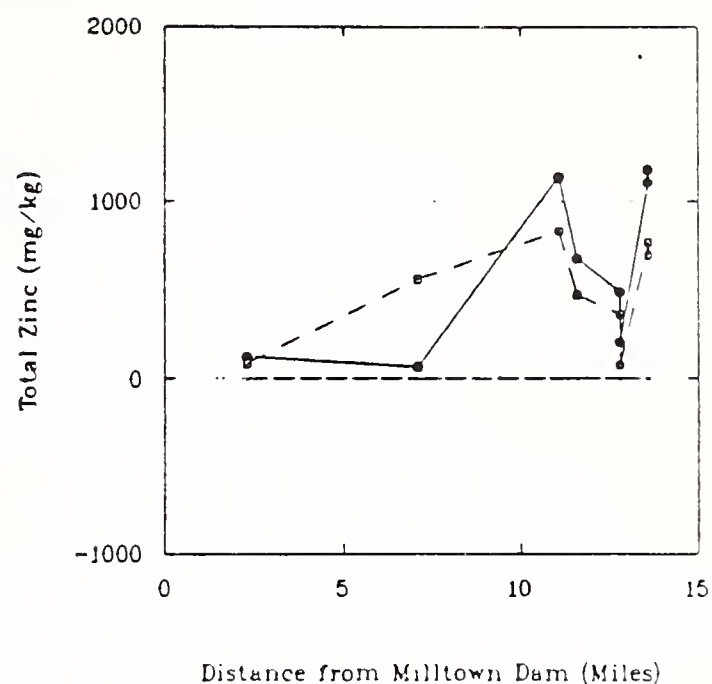


Figure 3.3-13 Total Manganese Concentration vs Distance Downstream of Milltown Dam

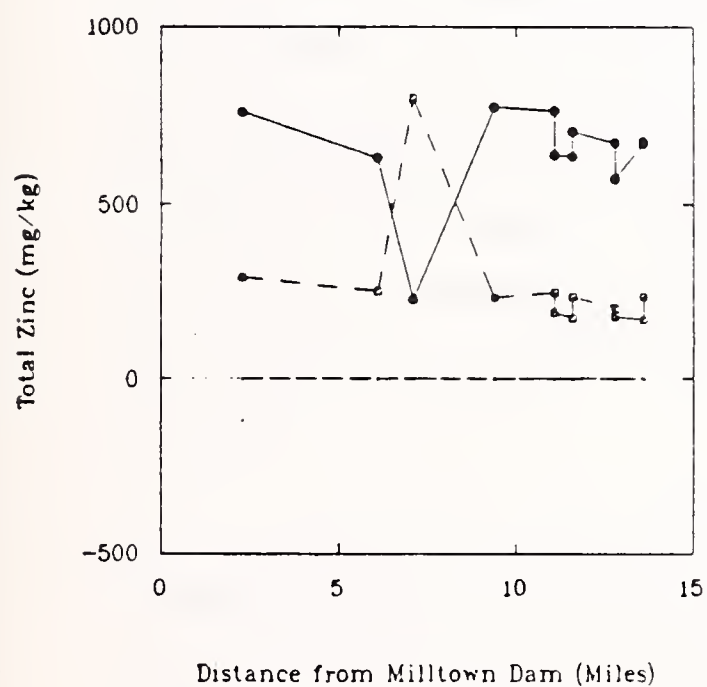
Total Zinc : Slack Water



Total Zinc : Low Floodplain



Total Zinc : Active Channel



Total Zinc : High Floodplain

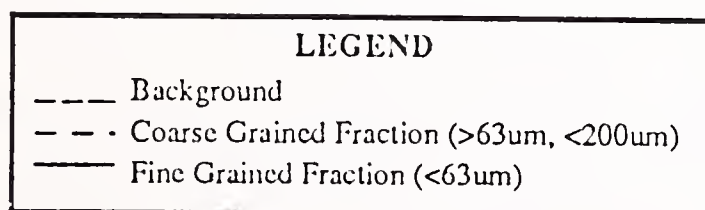
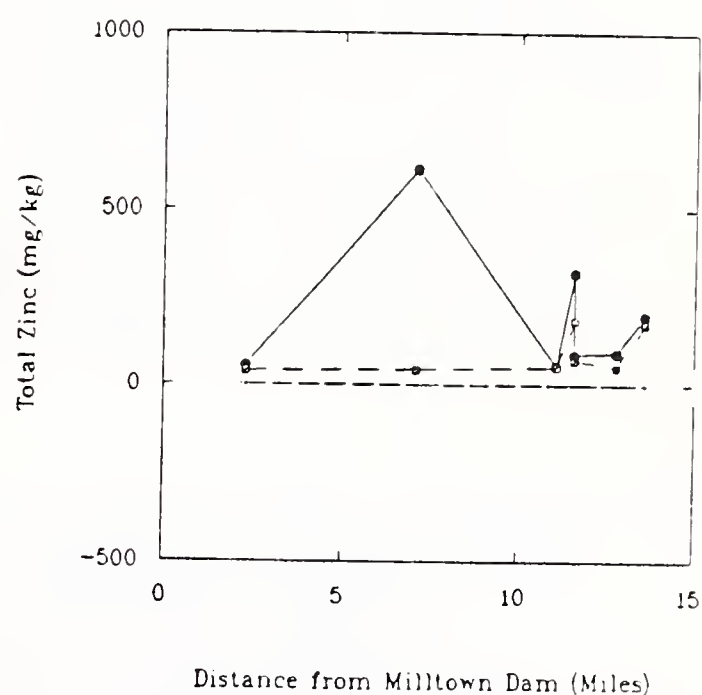


Figure 3.3-14 Total Zinc Concentration vs. Distance Downstream of Milltown Dam

lead. Arsenic, cadmium and zinc were more evenly distributed along transects.

No downstream trend in metals concentrations was evident in visual interpretation of Figures 3.3-8 to 3.3-14. Generally, fine grained metal concentrations exceeded coarse grained metal concentrations. An exception occurs at Transect 2 where, for all metals in the active channel bed and low floodplain sediments, fine grained and coarse grained metals concentrations were reversed. Furthermore, coarse grained concentrations represent peak concentrations at Transect 2 for the active channel physiographic area and fine grained fractions were typically low or below background. Transect 2 lies within the city limits of Missoula. The channel slope is steeper in this section than further downstream as evidenced by the lack of meanders and the cobbled nature of the stream bottom. The reason for the reversal of this location is not known, but may be related to a source of coarse grained materials high in trace metals unassociated with Milltown Reservoir. A visually determined concentration peak also occurs for all metals in the fine grained fractions of the high floodplain samples at Transect 2. Again, urban activities may have influenced this sample. High lead, copper and arsenic concentrations are also seen at Transect 6 in the high floodplain samples. Elevated levels for all metals were also detected in the low floodplain samples along this transect.

Background levels and averages obtained from previous studies were used for comparison with the current study results. Background levels are also presented in Figures 3.3-8 through 3.3-14 for visual comparison.

Enrichment over background was estimated for average fine and coarse grained metal concentrations. In general, fine grained copper and zinc sediments showed the most enrichment over background ranging from a factor of 10 to 15 in slack water, active channel and low floodplain samples. Copper concentrations in the fine grained sediments from the slack water areas demonstrated greatest enrichment, exceeding background by a factor of 25. Other enrichment factors are found in Table 3.3-4 along with average

TABLE 3.3-4
ENRICHMENT^a OVER BACKGROUND

	Total Arsenic	Total Cadmium	Total Copper	Total Lead	Total Iron	Total Manganese	Total Zinc
<u>Slack Water</u>							
Fine Gr	5.6	6.8	15	3	- ^b	1.6	12
Coarse Gr	2.2	* ^c	5	2	-	-	5.9
Max (Fine Gr)	8.2	2.8	25	4.6	-	2.5	1.9
<u>Active Channel</u>							
Fine Gr	5.8	6.4	14	3	-	2.4	11
Coarse Gr	2.4	*	1.5	-	-	-	4.5
Max (Fine Gr)	8.0	10	18	2.5	-	5.4	13
<u>Low Floodplain</u>							
Fine Gr	5.3	4.2	9	2.3	-	1.6	10.4
Coarse Gr	4.2	*	7	2.0	-	1.2	8
Max (Fine Gr)	9.2	6.8	16	3.3	-	2.4	20
<u>High Floodplain</u>							
Fine Gr	4.4	*	5.5	1.5	-	1.1	3.4
Coarse Gr	2.2	*	4.4	-	-	-	1.5
Max (Fine Gr)	15	2.6	19	2.6	1.2	2.0	10.2
<u>Background</u>	4.1	<0.5	20.0	17.5	14,100	480	60

^a Except as noted, the enrichment factor represents enrichment of mean metal concentration over background.

^b All iron concentrations below background.

^c * = Value not presented because of undetected values.

background values. Iron showed no enrichment above background in all cases. Overall, the greatest enrichment appeared to occur in slack water sediment samples. Cadmium was not included in this analysis as a result of several undetected values. However, when applicable, background cadmium levels were recognized taken as 0.5 mg/kg which is essentially the detection limit. Metals enrichment upstream of Milltown Dam by comparison exceeded background by ranges from 10 to 100 times that of background (Moore, 1985).

The significance of differences between fine grained metal concentrations in the slack water and active channel areas and the concentrations in low and high floodplains were investigated using Analysis of Variance (ANOVA). Prior to analysis, data from these physiographic areas were log transformed to normalize their distribution, a prerequisite to proper use of ANOVA. Individual metals concentrations for both active and slack water areas were compared to low and high floodplain areas. No correlation was seen between channel and floodplain deposits. Significant correlations were found between active channel and slack water areas for zinc, copper and lead. Low and high floodplain fine grained metal concentrations were also not significantly correlated. It appears that the highest metals concentrations reside in slack water and active channel sediments and are significantly different from both floodplain areas. Likewise, low floodplain sediments appear to be significantly higher in metals concentration than high floodplain sediments.

Comparison of data obtained by Savka (1988) with the fine grained fraction of the low floodplain sediments reinforced the concept of high variability in sediment metal concentrations within each physiographic area. In the present study, cadmium, copper and zinc concentrations were all higher than those obtained by Savka by factors of 2 to 4. Manganese values matched between the two studies while iron concentrations were higher by a factor of 2 in Savka's results.

3.4 IRRIGATED SOILS

The purpose of the irrigated soils investigation was to determine if the diversion of irrigation water below Milltown Dam on the Clark Fork River has affected the concentration of trace elements (particularly arsenic, cadmium, and copper) in agricultural lands. Two populations were selected for sampling: 1) lands receiving irrigation water from the Clark Fork; and 2) property with no known history of irrigation directly from the Clark Fork or any ditch carrying river water originating from the Clark Fork River. Several assumptions were made prior to selection of sampling location. First, that soils of the same soil type were assumed to be homogeneous enough to be able to discern a difference above and beyond the inherent influences grain size, texture, total organic carbon, and nutrients have on the soil's ability to retain trace metals. Secondly, it was assumed that paired sites (i.e., irrigated and non-irrigated) of the same soil type could be located within the study area and access approved for sampling.

Thirty soil samples were collected from four different soil types. Sample site selection was complicated by local use of municipal sludge as a soil amendment. Previous application of sludge disqualified several likely locations from sampling. Sample locations and associated soil types are listed in Table 3.4-1.

Summarized results of the sampling are presented in Table 3.4-2. Table 3.4-3 illustrates results by soil type. Regional background levels described by Bohn et al. (1979) and Schacklette and Boerngen (1984) have been added to the table for comparison purposes. Trace element concentrations resulting from this study indicate that both soil populations are within naturally occurring ranges. No discernible pattern was prevalent between irrigated and non-irrigated sites for any of the soil types. In fact, 11 of the sample pairs demonstrated a slightly higher trace element concentration in the control or non-irrigated sample.

TABLE 3.4-1
SAMPLE LOCATIONS AND ASSOCIATED SOIL TYPES

Soil Type	Location	Sample Numbers
GL	Topaz Drive	Irrigated - 1, 2, 3
GL	Grant Creek	Control - 10, 11, 12
DL	Mullan Road	Irrigated - 7, 8, 9
DL	Flynn Lane	Control - 4, 5, 6
ASL	Deer Creek Road	Irrigated - 13, 14, 15
ASL	Deer Creek Road	Control - 16, 17, 18
MGL	Speedway - Deer Creek	Irrigated - 28, 29, 30
MGL	Deer Creek Road	Control - 19, 20, 21
GL	Deer Creek Road	Irrigated - 25, 26, 27
GL	Deer Creek Road	Control - 22, 23, 24

GL = Grantsdale Loam

DL = Desmet Loam

ASL = Alberton Very Fine Sandy Loam

MGL = Moiese Gravelly Loam

TABLE 3.4-2

SUMMARY OF SOIL SAMPLING RESULTS^a

Sample No.	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
<u>Alberton Very Fine Sandy Loam (AVFSL)</u>						
- Control						
S0-016	5.60	<0.62	12.50	9.50	396.00	42.10
S0-017	4.80	<0.65	10.00	12.90	328.00	35.00
S0-018	4.20	0.78	10.90	8.60	375.00	37.90
- Irrigated						
S0-013	5.60	0.66	17.10	13.30	344.00	44.70
S0-014	4.90	<0.66	17.50	8.90	379.00	38.80
S0-015	4.30	0.75	9.60	7.80	245.00	33.90
<u>Desmet Loam (DL)</u>						
- Control						
S0-004	9.00	<0.70	30.20	19.30	419.00	58.50
S0-005	7.60	<0.66	31.20	14.90	325.00	60.40
S0-006	8.90	<0.64	29.40	14.90	344.00	61.80
- Irrigated						
S0-007	4.20	1.00	15.70	11.70	380.00	41.30
S0-008	5.90	<0.71	17.60	12.80	275.00	40.90
S0-009	5.80	<0.69	19.30	13.00	351.00	49.50

TABLE 3.4-2 (cont.)

SUMMARY OF SOIL SAMPLING RESULTS^a

Sample No.	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
<u>Grantsdale Loam (GL)</u>						
- Control						
S0-010	4.70	<0.66	15.80	10.50	480.00	52.90
S0-011	4.90	<0.64	14.10	7.50	390.00	45.90
S0-012	5.70	<0.64	13.30	8.10	443.00	48.00
S0-022-A	6.10	<0.65	22.10	12.40	611.00	61.60
S0-023-A	6.10	<0.66	20.10	11.20	609.00	54.60
S0-024-A	4.10	<0.65	17.80	11.60	559.00	53.30
- Irrigated						
S0-001	8.70	<0.71	74.50	17.80	171.00	69.80
S0-002	6.30	<0.62	35.40	11.10	324.00	51.70
S0-003	4.50	<0.67	30.20	12.20	387.00	56.20
S0-025	7.90	0.83	67.50	16.80	390.00	55.20
S0-026	<4.50	<0.63	12.90	10.50	345.00	36.00
S0-027	5.40	<0.64	21.90	9.80	364.00	49.60
<u>Moiese Gravelly Loam (MGL)</u>						
- Control						
S0-019	5.90	<0.70	24.90	16.10	992.00	74.50
S0-020	4.10	0.87	25.70	16.70	752.00	66.90
S0-021	8.90	0.74	26.80	15.80	608.00	67.60
- Irrigated						
S0-028	10.10	<0.64	24.10	24.00	374.00	61.20
S0-029	8.80	<0.64	27.20	24.70	336.00	64.80
S0-030	7.50	<0.64	25.30	12.60	360.00	42.60

^a = All values are mg/kg

TABLE 3.4-3

SUMMARY OF SOIL SAMPLING RESULTS BY SOIL TYPE^a
(All values in ppm)

Soil Type	Stat	Total Arsenic		Total Cadmium		Total Copper		Total Lead		Total Manganese		Total Zinc	
		Control	Irrigated	Control	Irrigated	Control	Irrigated	Control	Irrigated	Control	Irrigated	Control	Irrigated
Alberton Very Fine Sandy Loam (AVFSL)	n	3	3	3	3	3	3	3	3	3	3	3	3
	min	4.2	4.3	<0.62	<0.66		9.6	8.6	7.8	328	245	35	33.9
	max	5.6	5.6	0.78	0.75	10	17.5	12.9	13.3	396	379	42.1	44.7
	mean	4.87	4.93	<0.68	<0.58	12.5	14.73	10.33	10.00	366.33	322.67	38.33	35.13
	std	0.57	0.53	0.07	0.04	11.13	3.63	1.85	2.36	24.43	56.75	2.91 ^c	4.42
Desmet Loam (DL)	n	3	3	3	3	3	3	3	3	3	3	3	3
	min	7.6	4.2	<0.64	<0.69	29.4	15.7	14.9	11.7	325	275	58.5	40.9
	max	9	5.9	<0.7	1	31.2	19.3	19.3	13	419	380	61.8	49.5
	mean	8.50	5.30	<0.67	<0.80	30.27	17.53	16.37	12.50	63.67	335.55	60.21	43.90
	std	8.61	8.78	0.02	0.14	0.74	1.47	2.07	0.57	40.58	44.27	1.35	3.96
Grantsdale Loam (GL)	n	6	5	6	6	6	6	6	6	6	6	6	6
	min	4.1	4.5	<0.64	<0.62	13.3	12.9	7.5	9.8	390	371	45.9	36
	max	6.1	8.7	<0.66	0.83	22.1	74.5	12.4	17.8	611	390	61.6	69.8
	mean	5.27	6.56	<0.65	<0.68	17.20	40.40	10.22	13.03	515.33	330.17	52.72	53.08
	std	0.75	1.56	0.01	0.07	2.15	22.02	1.64	3.11	43.68	74.77	5.03	18.80
Moiese Gravelly Loam (MGL)	n	3	3	3	3	3	3	3	3	3	3	3	3
	min	4.1	7.5	<0.7	<0.64	24.9	24.1	15.8	12.6	608	336	66.9	42.6
	max	8.9	10.1	0.87	<0.64	26.8	27.2	16.7	24.7	992	374	74.5	64.8
	mean	6.30	8.80	<0.77	<0.64	25.80	25.53	16.20	20.42	784.00	356.67	69.67	36.20
	std	1.98	3.06	0.07	0.80	0.78	1.28	0.37	5.55	158.38	15.69	3.43	9.73
Schacklette (1984) ^b Western	mean	5.5				21		17		380		55	
	range	<1-97				2-300		<10-700		30-5,000		10-21,000	
U.S. Soils (Bohn) ^c (1979)	mean	5		.06		20		10		850		50	
	range	1-50		.01-7		2-100		2-200		100-4,000		10-300	

^a All values in mg/kg^b Schacklette, H.T. and Josephine G. Boerngen. 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. U.S.G.S. Survey Professional Paper 1270.^c Bohn, H.L.; B.L. McNeal; and G.A. O'Conner. 1979. Soil Chemistry, John Wiley & Sons, New York.

If irrigation water was a source for added metals, and potential metal losses (i.e., erosion and plant uptake) are considered equal, soils with higher cation exchange capacity (CEC) would be expected to have adsorbed and accumulated higher concentrations of metals. Desmet Loam and Grantsdale Loam have higher clay content which would generally indicate a higher CEC than the Alberton Very Fine Sand Loam and the Moiese Gravelly Loam. However, no difference was found in the metal concentrations among the four soil types sampled in this study (Figures 3.4-1 - 3.4-6).

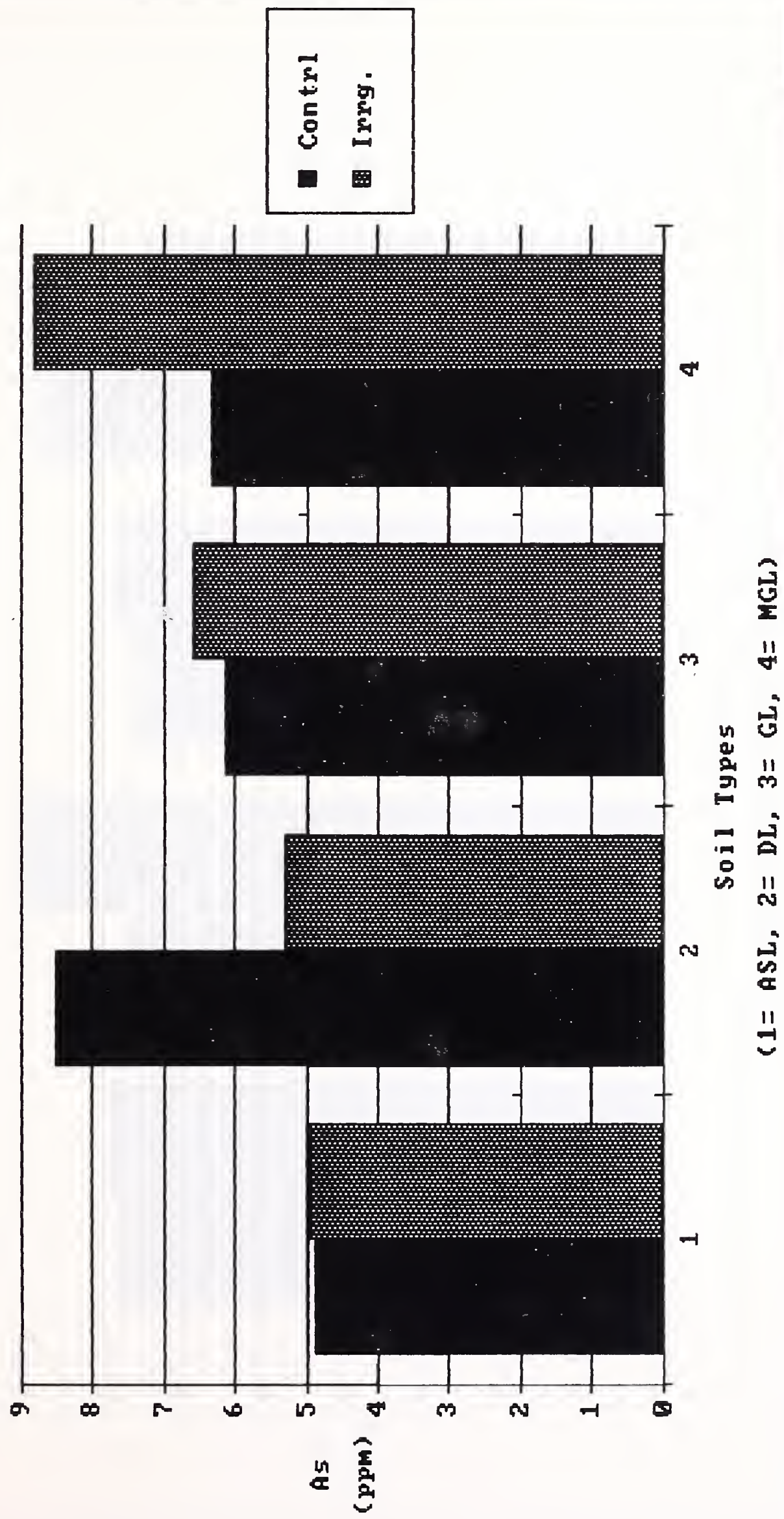


Figure 3.4-1
Screening Study Soils Comparison - Arsenic

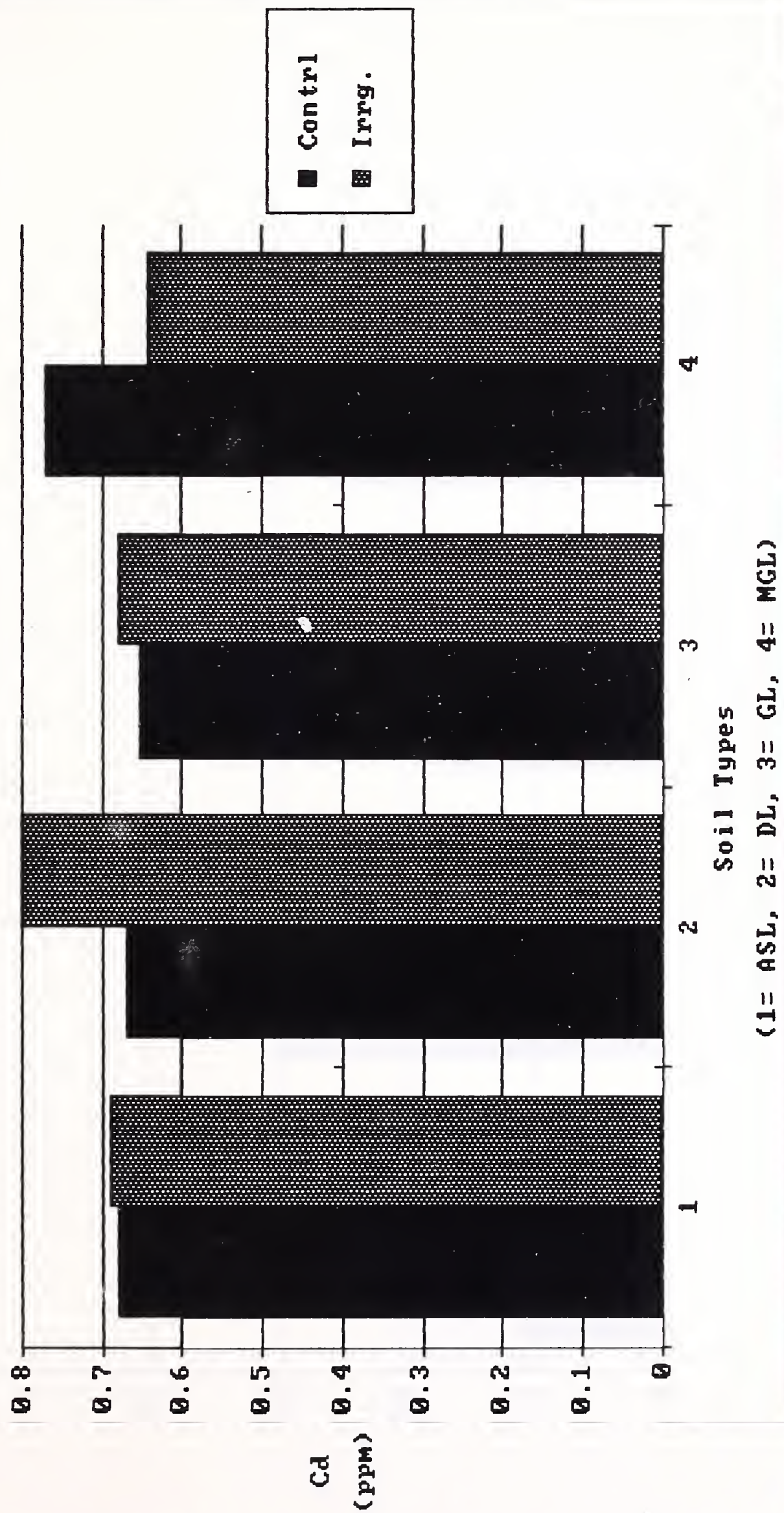


Figure 3.4-2
Screening Study Soils Comparison - Cadmium

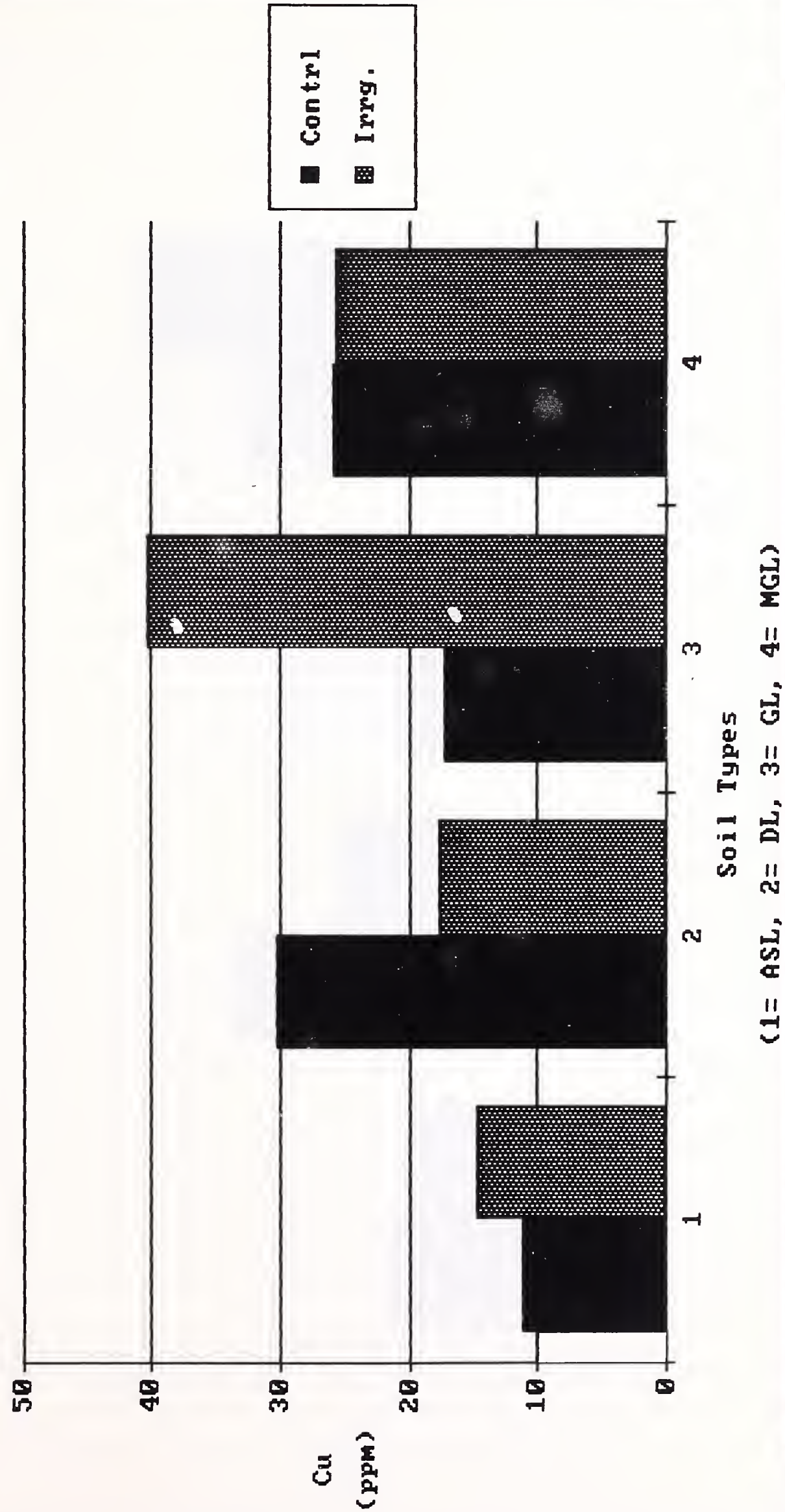


Figure 3.4-3
Screening Study Soils Comparison - Copper

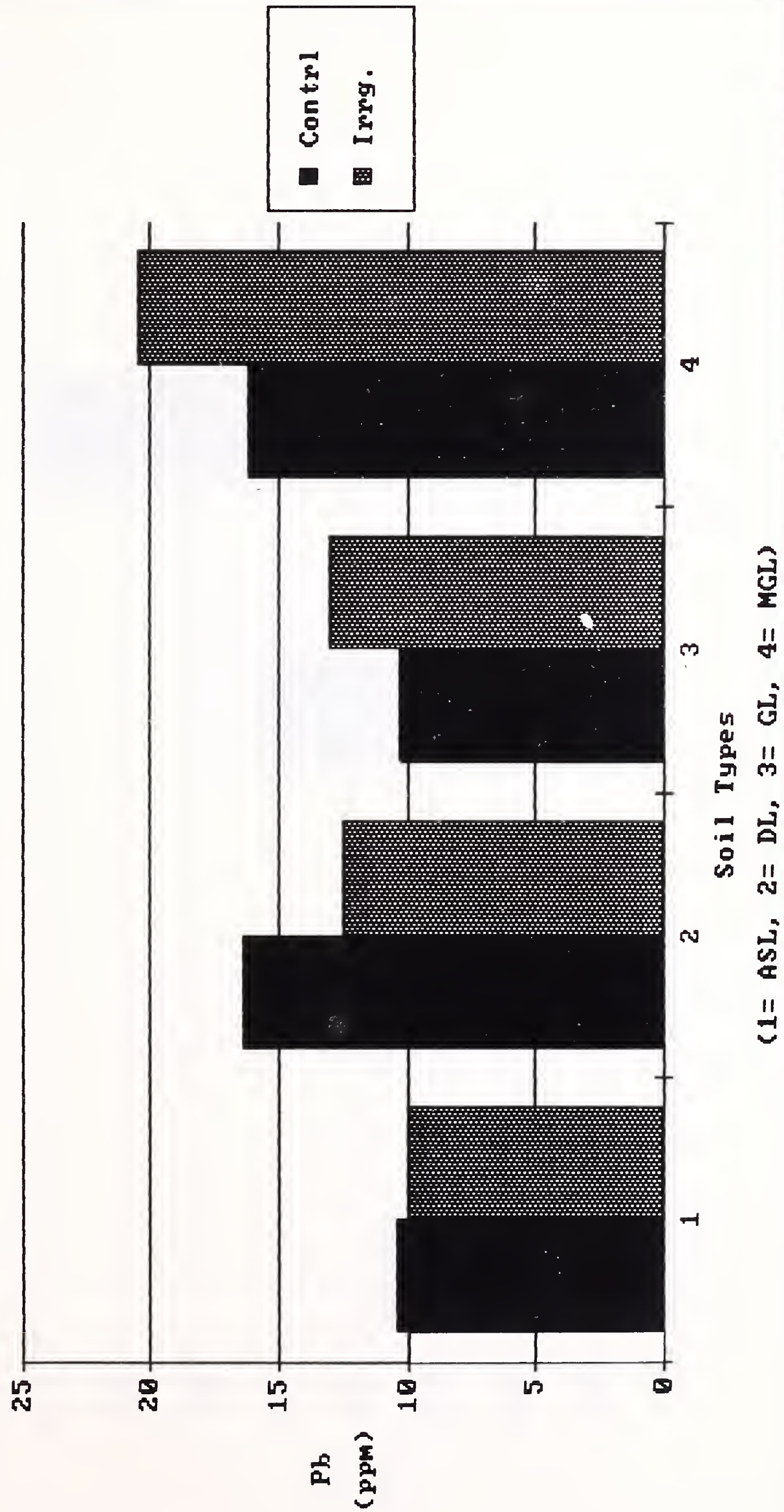


Figure 3.4-4
Screening Study Soils Comparison - Lead

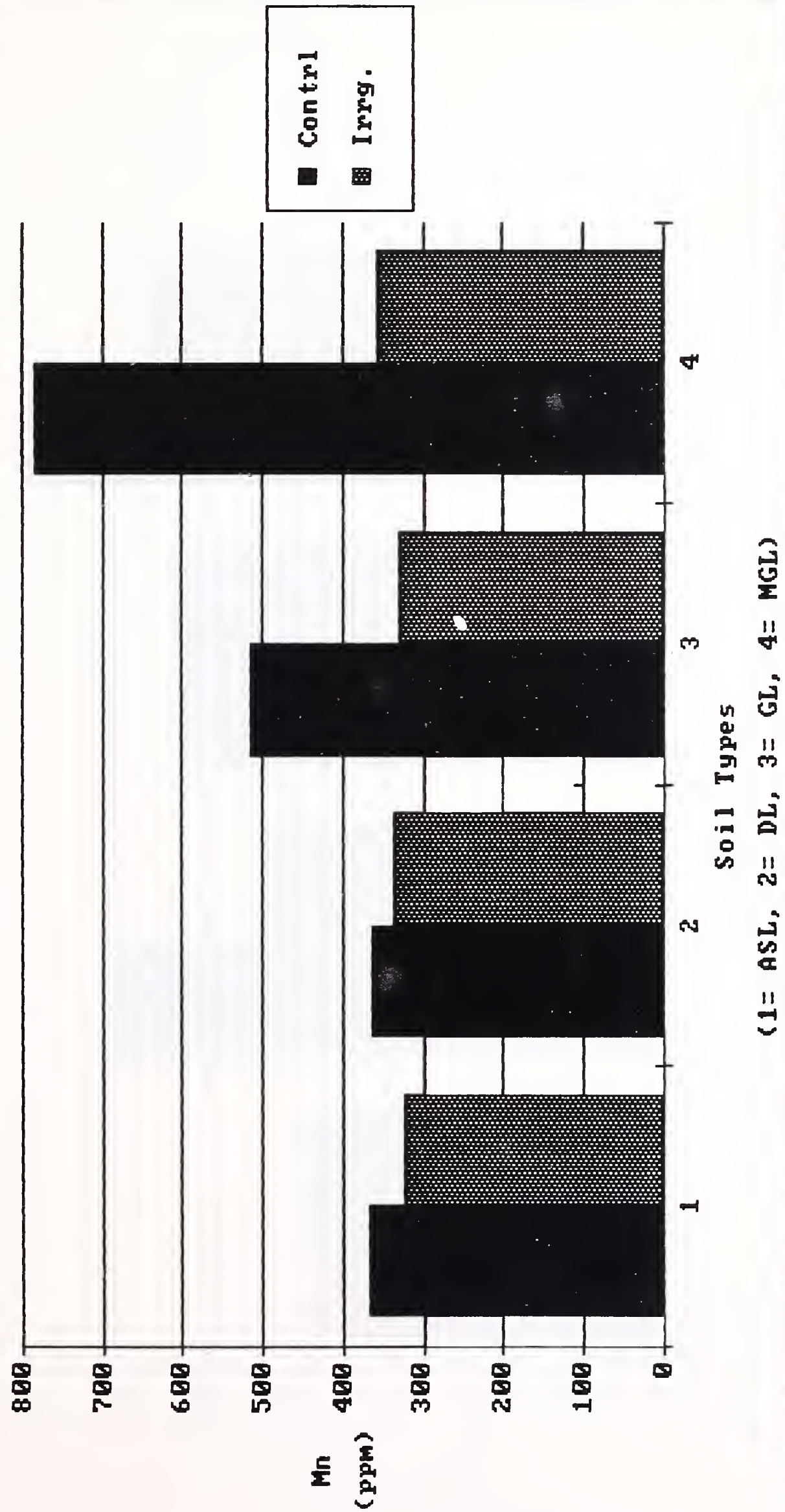


Figure 3.4-5
Screening Study Soils Comparison - Manganese

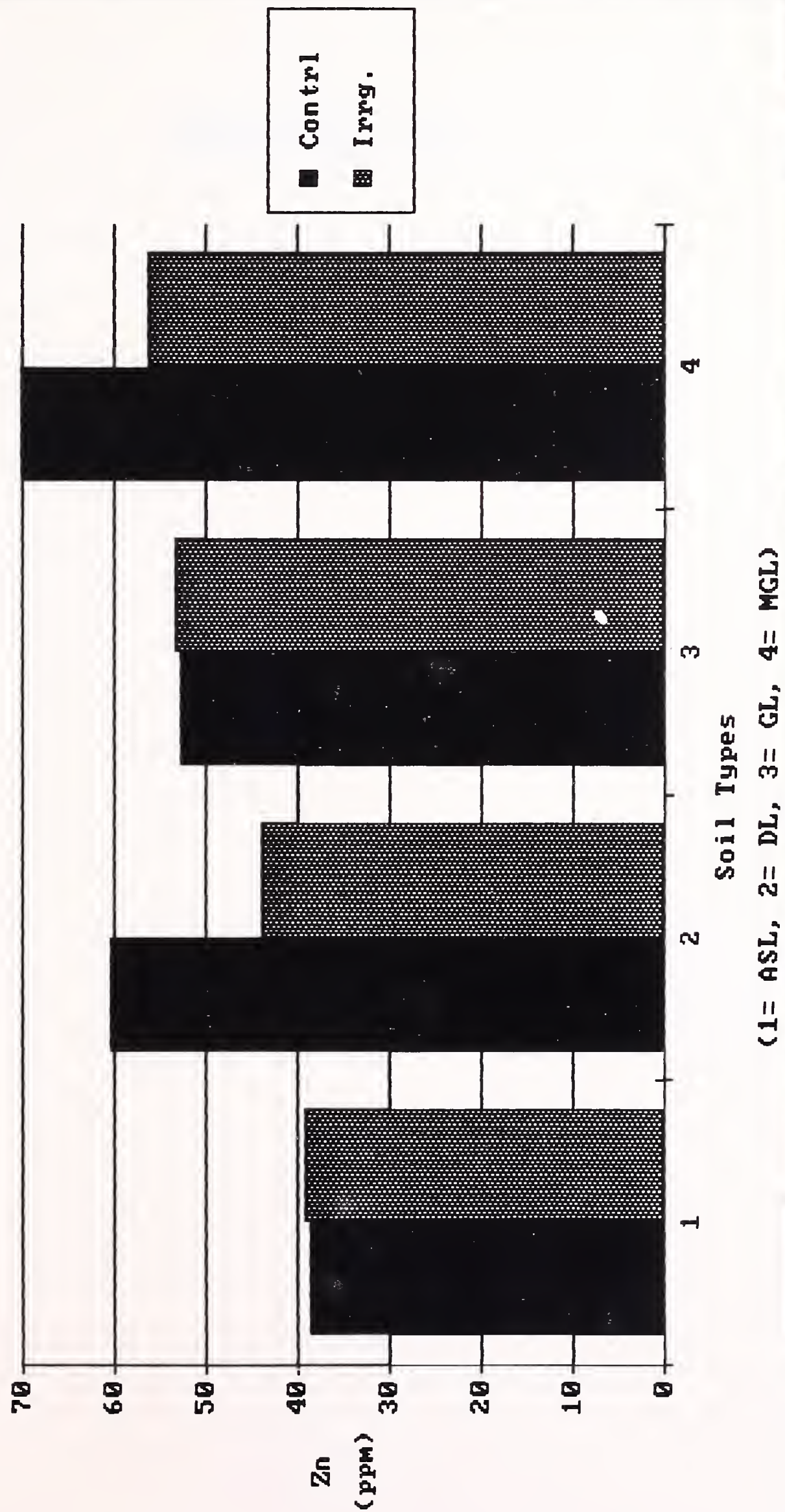


Figure 3.4-6
Screening Study Soils Comparison - Zinc

SECTION 4.0

4.0

4.0 CONCLUSIONS AND RECOMMENDATIONS

The Milltown Reservoir Site Downstream Screening Study consisted of four investigations; surface water, ground water, river sediments, and irrigated soils. The following sections present conclusions and recommendations pertinent to study findings for each of these media.

4.1 SURFACE WATER

Analytical results from June, 1988 sampling (prior to reservoir water level reduction) are similar to data obtained during previous investigations along the study reach of the Clark Fork (MDHES, 1985). Changes in water quality were noted downstream of the dam during monitoring of the reservoir drawdown. Total suspended solids and trace elements increased during drawdown relative to upstream stations. A relationship between total suspended solids and total metals was identified, however, additional work is needed to quantify this relationship.

Dissolved trace element concentrations did not exceed Clean Water Act primary MCLs before or during reservoir drawdown. Only one secondary MCL, manganese, was exceeded during the study (at the East Missoula Station). Dissolved copper did approach the acute Aquatic Life Criterion at the East Missoula Station indicating the potential for some environmental risk.

Sediments obtained from the the active channel at Turah, Bonner and East Missoula stations indicated higher trace metal values associated with the fine grained (<63 micron size) fraction. Trace metal values were generally lower for the Blackfoot River sediments than those from the Clark Fork. Trace metals for the fine sediment (<63 micron size) fraction were also observed to be higher downstream from the reservoir. For the larger particle fraction (>63 micron size), this trend was reversed and the trace metal values were higher at the Turah Station. Both size fractions show a

progressive increase in metal concentration below the dam (at the East Missoula Station) during the drawdown event. This trend was not observed at the other stations during the sampling period.

Sampling during the "controlled" drawdown indicated a significant increase in total suspended solids and concentrations of total trace elements. Based on this result, it is recommended that Future Feasibility Study activities be developed to adequately address or model the release of sediment resulting from reservoir management activities and naturally occurring flow conditions (including extreme events).

4.2 GROUND WATER

4.2.1 ARSENIC CONCENTRATION

The results of the Downstream Screening Study ground water sampling have detected levels of arsenic and manganese which exceed primary and secondary drinking water standards, respectively, near the Milltown Dam and Reservoir. Slightly elevated concentrations may also exist in the western part of the study area when compared to values in adjacent wells, but all contaminant levels in this area were well below primary drinking water standard of 50 µg/l, indicating that an imminent threat to health does not exist at this time. The concentration of arsenic detected in the 1988 samples are higher than those observed in 1986, which could indicate that the ground water quality is continuing to degrade through ongoing releases to the ground water system. Because of the absence of existing wells in the intermediate portion of the study area, it is unknown if the conditions in the east and west portions of the study area are part of a single contaminant plume. The extent of ground water containing arsenic above recommended standards also cannot be determined. Based on these conclusions, the following recommendations are made:

- o That ground water quality continue to be monitored on a regular basis in the area of the potential arsenic plume. The purpose for this is to detect if degradation of the ground water quality is

occurring, and to insure that ground water users do not receive water containing undesirable levels of arsenic.

- o Additional ground water monitoring wells should be installed in the intermediate portion of the study area. Their purpose would be to confirm the existence of a narrow plume of elevated trace metals, especially arsenic, originating near Milltown Reservoir; and the extent of arsenic and manganese in the ground water system at levels exceeding recommended standards could also be determined. Such a network could also provide early warning of approaching contamination to ground water users in the Juniper Drive area.

4.2.2 MILLTOWN COMMUNITY WELLS

The water sample results from the log pond show the presence of several organic constituents including some priority pollutants, as well as elevated levels of some inorganic parameters. The ground water samples from nearby community supply wells contained very low levels of phenol, the only organic constituent detected. One sample also contained cadmium at the 10 µg/l standard for drinking water. Review of field and laboratory quality assurance samples indicate that the cadmium detected is probably not representative of the ground water system. Sampling should be considered to verify this conclusion. The presence of phenol in the ground water is probably related to weathering of lignins. Phenol was also detected in the log pond and could be the source of that observed in the wells. The source of the phenol could also be through direct infiltration from the log storage area or some other as yet unidentified area. The community supply wells are reported to derive water from a deep alluvial zone, isolated from the overlying shallow alluvial zone. This would imply that the source of the phenol may not actually be the log pond. Should subsequent sampling detect increased levels of phenol and/or other organic constituent, health risk modeling should be considered so as to establish levels of concern.

4.2.3 SOLE SOURCE AQUIFER

A review of Missoula's Sole Source Aquifer Application indicates that potential for contamination of the Missoula Valley Aquifer exists, especially to wells nearest the Clark Fork River. This is due to the

significant recharge to the aquifer from the Clark Fork River and limited attenuation mechanisms present. A detailed mass-balance analysis should be performed for the Missoula Aquifer and the contribution to it from the Clark Fork River. Mixing calculations to determine impacts to the water supplies under a worst case scenario should also be performed in light of the wide range of remediation alternatives being considered for the sediment source areas, including the Milltown Reservoir.

4.3 RIVER SEDIMENTS

As part of the Downstream Screening Study, sediments were sampled from physiographic areas of fluvial deposition; namely, slack water, low velocity zones in the active channel, and low and high floodplains. Samples from each physiographic area were taken along six transects between Missoula and the Bitterroot River. Fine grained, <63 microns, and coarse grained, >63 but <200 microns, fractions were analyzed for trace metal concentrations. Of particular concern were arsenic, cadmium, copper, lead, iron, manganese, and zinc. In general, metals concentrations in fine grained material exceeded levels in the coarse grained fractions except at Transect 2. Transect 2 lies within the city limits of Missoula in a steeper sloped section of the Clark Fork compared to the other transects. Contaminated coarse grained material may be introduced to the Clark Fork by urban activities at this point, or deposition of fine grained sediment may be modified in this reach due to the increased gradient.

Downstream trends in metal concentrations were not apparent in this 13 mile stretch of the Clark Fork River. This may be caused by the high spatial variability in metal distribution and the short stretch of river sampled. Previous studies noted a decreasing downstream trend in metal concentrations over the 100 mile stretch between Warm Springs and Milltown. Spatial variability was analyzed in this study using statistical analysis of variation on "repeat samples", samples taken at two different locations within one physiographic area. High spatial variation was apparent for

iron, manganese, copper and lead. Arsenic, cadmium, and zinc were more evenly distributed within each physiographic area.

Sediments collected between Missoula and the Bitterroot River showed enrichment over tributary background levels for all seven metals of concern except iron. Background values represent concentrations reported in existing literature for the Blackfoot, the Little Blackfoot, and the Bitterroot, Rock Creek and the Missoula Lake beds. Copper and zinc exceeded background by factors of 10 to 15; while arsenic, manganese, lead and cadmium were 1.5 to 7 times higher than background. Coarse grained fractions also exceeded background, though at a lower level. However, compared to enrichment factors of 10 to 100 times reported for the upper Clark Fork, metal concentrations in this section were reduced. Andrews (1987) results indicate that, by the confluence with the Flathead River, concentrations of metals were approximately equal to background.

To determine if metals were concentrated in one physiographic area, each of the four depositional regimes was statistically compared to the others. For all metals of concern except iron, concentrations in slack water and active channel sediments are significantly higher than both floodplain areas. Low floodplain sediments also showed higher levels than high floodplain sediments for the above metals. Low floodplain sediments may offer a higher degree of mixing with uncontaminated sediments because of historical changes in river flow paths and the large aerial extent and volume of sediments present in the low floodplain versus slack water and active channel sediments. It appears that active deposition has not occurred on the high floodplain within the last century.

The present study represents a preliminary screening of sediment contamination between Missoula and the Bitterroot River. Active channel and slack water physiographic areas contained the highest concentration of trace metals within the transects. To confirm this with a higher level of confidence would require a larger sample size. Active channel and slack water sediments continue to be mobile, whereas floodplain sediments remain

relatively stable in their present locations. Further study, if deemed necessary, should be directed toward major impoundment areas downstream where mobile sediments may continue to collect, concentrating contaminants.

Fine grained materials were used primarily to compare spatial distributions of metals in riverine sediments. Obtaining bulk metal concentrations and grain size analysis would allow determination of bulk contribution to sediment contamination and an assessment of which size fraction contributes most to total metal concentration in the bulk sample.

The scope of this study did not include assessing health and environmental risks of the trace metal enriched sediments downstream of the Milltown Dam. If the EPA and the MDHES establish action levels for sediment contamination that are exceeded by the screening study results, then further investigation of the downstream sediments may be warranted. If further assessment is necessary, the following issues should be addressed: receptors of contaminated sediment; mobilization potential of low floodplain, active channel and slack water sediments; and identification of other potential sources of contamination downstream of the Milltown Dam.

4.4 IRRIGATED SOILS

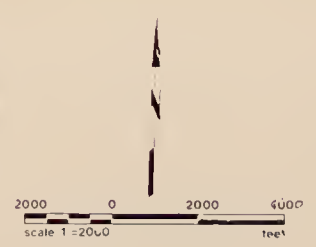
The irrigated soils phase of the Screening Study involved collection of 30 samples (15 pairs) from four indigenous soil types. Soil types had recently been mapped and classified for the Missoula County by the Soil Conservation Service. Samples were obtained from two populations both within the same soil type - one irrigated with Clark Fork River water and the other not.

Results indicate no apparent difference in trace metal concentrations between irrigated and non-irrigated pairs. Furthermore, no differentiation between soil types could be determined based on trace metal concentrations observed by this study. After consideration of the data generated by the irrigated soils subtask, no further investigation of this issue is recommended.

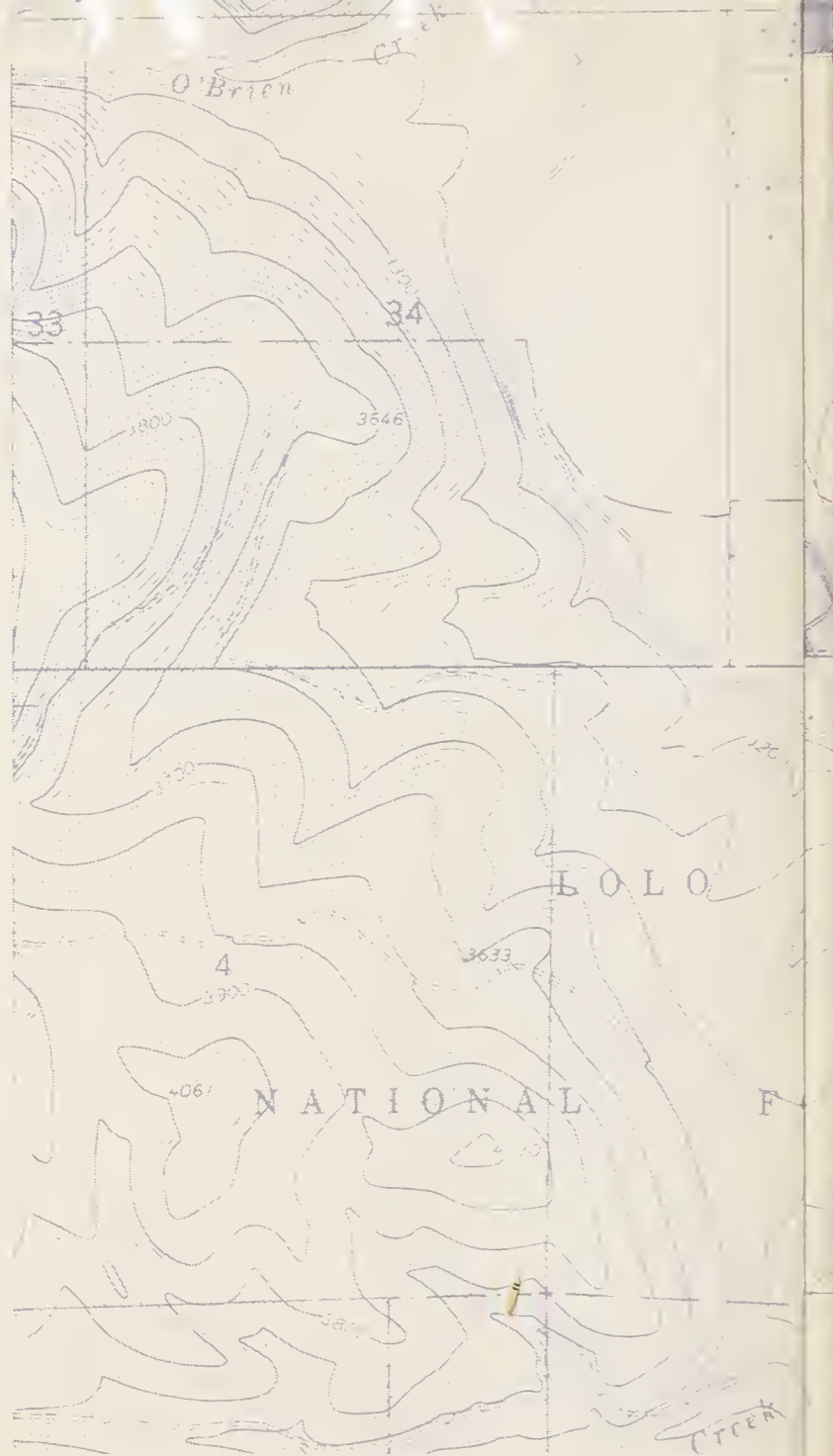


LEGEND

- OR ● A, A1 - ACTIVE CHANNEL BED SEDIMENT SAMPLE LOCATION
- B, B1 - SLACK WATER BED SEDIMENT SAMPLE LOCATION
- C, C1 - LOW FLOODPLAIN SAMPLE LOCATION
- D, D1 - HIGH FLOODPLAIN SAMPLE LOCATION
- ROUTE OF CLARK FORK RIVER ESTIMATED FOR OCTOBER
- ▲ SOIL SAMPLE LOCATION AND NUMBER
- SURFACE WATER SAMPLE LOCATION



MILLTOWN DOWNSTREAM SCREENING STUDY	
LOCATION MAP	
CAMP DRESSER & MCKEE INC.	PLATE 1
CDM environmental engineers, scientists, planners, & management consultants	



LEGEND

- OR ● A, A1 - ACTIVE C
- B, B1 - SLACK W
- C, C1 - LOW FLO
- D, D1 - HIGH FLO
- ▨ ROUTE OF CLARK
- ▲ SOIL SAMPLE LOC
- SURFACE WATER

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REFERENCES

REFERENCES

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APPENDIX 5.1

QUALITY ASSURANCE/QUALITY CONTROL

APPENDIX 5.1

QUALITY ASSURANCE/QUALITY CONTROL

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QUALITY ASSURANCE/QUALITY CONTROL

1.0 INTRODUCTION

Quality assurance (QA) is the integrated program implemented to ensure the generation of data of documented and adequate quality to allow appropriate decisions to be made. Quality control (QC) is the application of specific procedures to determine and measure the performance or degree of implementation of stated quality assurance objectives. Quality control procedures are used to define whether sampling and analytical techniques resulted in generation of data within specified control limits.

The EPA Contract Laboratory Program (CLP) has been utilized to analyze all Milltown project samples. A randomly selected subset of twenty percent by matrix of all data generated during the Milltown Reservoir Sediments Site and Milltown Downstream Screening Study investigations has been selected for full data validation based on the EPA Functional Guidelines for Validation of Inorganics Data. The selected subset of samples included only a portion of the field and laboratory quality control data related to precision and accuracy results.

Analytical quality control samples (laboratory duplicates, spiked samples, blanks, etc.) are examined in the data validation process to "qualify" data in terms of limitations of analytical data quality (accuracy and precision). Within the EPA CLP data validation process, data qualification is performed by assigning letter codes ("flags") to the reported analytical results based upon noncompliance with EPA Functional Guidelines requirements/guidance and also on professional judgement. As a result of the 20 percent data validation rate, there may be reported results that would have been flagged if validated.

Field quality control samples are collected to facilitate estimation of variability associated with aspects of the entire sampling and analysis process. Field QC samples may include field duplicate samples (a split of a homogenized sample or collocated samples), field blanks, decontamination rinsate blanks, and travel blanks or bottle blanks. Field QC protocols and objectives are defined in the Sampling and Analysis Plan(s) for the Milltown Downstream Screening Studies. Field quality control samples for the Downstream Screening Study included:

- o Bottle/Reagent Blanks (also referred to as travel blanks in this study) - Analyte-free water with appropriate preservatives which are added to sample containers, transported to the field during sample collection, and sent blind or unidentified as a QC sample to the laboratory for analysis. Bottle/reagent blanks remain **unopened** during the sample collection process. These blanks provide an indication of inadvertent sample contamination from reagents or sample containers.
- o Field Blanks - Analyte-free water with appropriate preservatives which are added to sample containers, prepared in the field at the sampling location, and sent blind to the laboratory. Field blanks provide an indication of inadvertent sample contamination from the ambient atmosphere as well as from sample containers or preservatives.
- o Field Duplicates - For surface water samples, field duplicates consisted of a single sample split into two sample containers and analyzed separately. This type of field duplicate (split sample) provides an estimation of the variability introduced during the

sample preservation, handling, and analysis process.

For solid samples and for ground water(residential wells), field duplicates consisted of collocated, discrete samples collected from an individual sampling station at the same time. This type of field duplicate (collocated sample) provides an estimate of the variability inherent in the environmental medium being sampled as well as an indication of the variability introduced during the sample collection, handling, and analysis process.

- o Decontamination Rinsate Blanks - Analyte-free water passed over or through the sample collection equipment, appropriately preserved, and sent blind to the laboratory. Decon/rinsate blanks provide an indication of the effectiveness of the equipment decontamination procedures and, therefore, a measure of the cross-contamination of samples collected consecutively over time.
- o Performance Evaluation (PE)/Standard Reference Material (SRM) - PE/SRM samples are materials of known, documented composition which have been prepared by, or obtained from EPA approved sources, which are sent blind to the laboratory for analysis. PE/SRM samples provide an independent (augmenting the CLP lab performance evaluation/audit procedures) measure of analytical performance (accuracy and precision).

The evaluation of the data from the Milltown Downstream Screening Study presented herein includes a consideration of not only the laboratory accuracy and precision limits of reported data but also an evaluation of field QC data and a discussion of its impacts on application of reported results to intended data uses. Goals and objectives of the Milltown project investigations are included in the individual Sampling and Analysis Plans (SAPs) for the Downstream Screening Study.

2.0 STANDARD REFERENCE MATERIALS/PERFORMANCE EVALUATION MATERIALS

EPA PE/SRM samples are used in the Milltown Study investigations as "blind" QC samples for laboratory analysis to evaluate laboratory performance and provide an indication of accuracy or bias associated with reported results of environmental samples. Results of performance of the blind PE/SRM materials augment the routine CLP laboratory performance evaluation/audit procedures of participating laboratories.

PE/SRM materials were analyzed during both the Reservoir Sediment Study and the Downstream Screening Study. Unfortunately, the PE/SRM samples were analyzed too infrequently to allow calculation of mean values, standard deviations, or coefficients of variation for the CLP results. Accuracy of reported results, expressed as percent recovery (%R) of the CLP reported value compared with the actual PE/SRM value, was calculated. The PE/SRM materials used in these studies have reported control or advisory ranges, presented in Tables 1 and 3, as well as "true" mean values. The control or advisory ranges for the PE/SRM materials should be considered when evaluating reported CLP results for these materials.

Percent recovery (%R) is defined in this discussion as :

$$\% R = (\text{FOUND} / \text{TRUE}) \times 100$$

where TRUE = actual PE/SRM value, and FOUND = CLP reported value.

2.1 Milltown Downstream Screening Study (Task 1)

Aqueous PE/SRM: The aqueous matrix PE/SRM sample used during this study is the PotableWatR™ obtained from Environmental Resource Associates (era), Arvada, Colorado. Table 1 presents the true value means and advisory ranges for this PE/SRM material for the analytes arsenic, cadmium, iron, lead, and manganese. Table 2 presents the CLP laboratory analytical results, percent recovery (%R), and qualifiers, if any, for this PE/SRM material, identified as environmental sample SWDS-008.

Proper preparation of this PE/SRM material by field personnel for analysis by the CLP laboratory is in question. Therefore, the significance of CLP performance based upon an evaluation of PE/SRM sample analysis and its impact on interpretation of Milltown Screening Study results could not be verified with the information provided. With this in mind, the performance of the CLP laboratory on the first PE/SRM sample, SWDS-008, cannot be evaluated, although a consistent high bias in the reported results is implied. The apparent performance of the CLP laboratory on the second PE/SRM sample, also SWDS-008, for the analytes arsenic, cadmium, copper, lead, manganese and iron was apparently acceptable based upon the percent recovery (%R) of from 88 to 115 percent from the "true" mean values. This PE/SRM does not include zinc. (The advisory ranges for the PotableWatR™ PE/SRM are +/- 20 % from the established "true" mean value.)

Solid PE/SRM: The solid matrix PE/SRM sample used for the Milltown Reservoir Sediments Site investigations was obtained from the EPA and is identified as LCS 0287. This material consists of mine tailings with "true" value means and control limits determined by the EPA EMSL/LV through collaborative round-robin studies. Table 3 presents the means and standard deviations for this SRM for the analytes arsenic, cadmium, copper, iron, lead, manganese, and zinc. Table 2 also presents the results of CLP analysis of LCS 0287, identified as samples

TABLE 1 - Potable WatR™, Quality Control Samples, LOT NO. 2511

<u>Parameter</u>	<u>era Certified Value</u> <u>ug/l (ppb)</u>	<u>Advisory Range</u> <u>ug/l (ppb)</u>
Arsenic	41	33- 49
Cadmium	115	92-138
Iron	113	90-136
Lead	166	133-199
Manganese	179	143-215

FROM: Environmental Resource Associates (era)
Arvada, Colorado 80002

TABLE 2
Milltown Reservoir Sediment Site Study
Performance Evaluation Sample Results

		ARSENIC				CADMIUM				COPPER				IRON				
Site Location	Sample ID	True ID	FOUND	TRUE	% R	DQ	FOUND	TRUE	% R	DQ	FOUND	TRUE	% R	DQ	FOUND	TRUE	% R	DQ
Total Metals (Aqueous)																		
Shuffields	SWDS-008	PotableWatR(TM)	74.0	41.0	180.5%	N	223.0	115.0	193.9%	N	6.0	N/A	N/A	N	910.0	113.0	805.3%	N
Shuffields	SWDS-008	PotableWatR(TM)	36.1	41.0	88.0%	N	118.0	115.0	102.6%	N	7.8	N/A	N/A	N	131.0	113.0	115.9%	N
Total Metals (Solid)																		
Std. Ref. Material	2-SD-004-A-P	LCS 0287	1000.0	917.0	109.1%	N	34.2	45.4	75.3%	N	5620.0	6910.0	81.3%	N	18700.0	22430.0	83.4%	N
Std. Ref. Material	5-SD-004-A-P	LCS 0287	1300.0	917.0	141.8%	JS	32.9	45.4	72.5%		5400.0	6910.0	78.1%		17900.0	22430.0	79.8%	

		LEAD				MANGANESE				ZINC				
Site Location	Sample ID	True ID	FOUND	TRUE	% R	DQ	FOUND	TRUE	% R	DQ	FOUND	TRUE	% R	DQ
Total Metals (Aqueous)														
Shuffields	SWDS-008	PotableWatR(TM)	325.0	166.0	195.8%	N	353.0	179.0	197.2%	N	409.0	N/A	N/A	N
Shuffields	SWDS-008	PotableWatR(TM)	169.0	166.0	101.8%	N	184.0	179.0	102.8%	N	8.5	N/A	N/A	N
Total Metals (Solid)														
Std. Ref. Material	2-SD-004-A-P	LCS 0287	219.0	236.0	92.8%	N	169.0	208.0	81.3%	N	160.0	187.0	85.6%	N
Std. Ref. Material	5-SD-004-A-P	LCS 0287	216.0	236.0	91.5%		163.0	208.0	78.4%		155.0	187.0	82.9%	JE

NOTES: Questionable preparation of SWDS-008 performance evaluation sample in the field

KEY: N - not validated
 FOUND is the reported CLP result; TRUE is the actual value
 JS - value estimated due to matrix spike recovery problems (matrix interference)
 JE - value estimated due to chemical, physical, or spectral interference problems noted in serial dilutions in sample analysis

TABLE 3. "TRUE VALUE" CONCENTRATIONS AND CONTROL LIMITS FOR THE
ELEMENTS IN THE SOLID LABORATORY CONTROL SAMPLE LCS (0287)

Element	"True Value" (mg/kg)	Control Limits (mg/kg)		
As	917	635	to	1199
Cd	45.4	35.7	to	55.1
Cu	6910	6006	to	7820
Fe	22430	17770	to	27080
Pb	236	188	to	285
Mn	208	177	to	239
Zn	187	138	to	236

2-SD-004-A-P and 5-SD-004-A-P, compared to the established "true" mean values.

The CLP laboratory performed within control limits for all LCS 0287 analyses. Results for sample 2-SD-004-A-P indicate that reported values for arsenic, cadmium, copper, iron, lead, manganese and zinc are all within the established control limits for LCS 0287.

Results for 5-SD-004-A-P indicate that the reported arsenic, cadmium, copper, iron, lead, manganese and zinc values were all within the established control limits for LCS 0287. The data validation process indicated that matrix interference problems were experienced during analysis of arsenic and zinc in sample 5-SD-004-A-P by the CLP laboratory. The reported values for arsenic and zinc were within the reported control limits although, based upon the data validation process, the reported values should be considered estimated.

2.2 Milltown Downstream Screening Study (Task 2)

Solid PE/SRM: The solid matrix PE/SRM sample used for the Milltown Downstream Screening Study investigations was obtained from the EPA and is identified as LCS 0287. This material consists of mine tailings with "true" value means and control limits determined by the EPA EMSL/LV through collaborative round-robin studies. Table 3 presents the means and standard deviations for this SRM for the analytes arsenic, cadmium, copper, lead, and zinc. Table 4 presents the results of CLP analysis of LCS 0287, identified as environmental sample SQ-001-P, compared to the established mean values.

The CLP laboratory performed within control limits for all LCS 0287 analyses. Results indicate that the reported values for arsenic, cadmium, copper, iron, lead, manganese and zinc are all within the established control limits for LCS 0287.

3.0 FIELD DUPLICATE SAMPLE RESULTS

Duplicate samples were analyzed during both the Reservoir Sediment Study and the Downstream Screening Study. Precision of reported results, expressed as relative percent difference (RPD) between the duplicate values, was calculated.

RPD's are defined in this discussion as :

$$RPD = \frac{D1-D2}{((D1+D2) \times 0.5))} \times 100$$

where D1 = first duplicate value, and D2 = second duplicate value.

Note that "DQ" in the tables refers to data qualifiers.

Functional Guidelines Duplicate Precision Criteria --

The EPA Functional Guidelines for Validation of Inorganic Data has recommended criteria for evaluating acceptability of duplicate precision values. The criteria are listed below:

Aqueous Matrices (ug/l):	$\pm$ 20 percent RPD $\pm$ CRDL if result < 5 times CRDL
Solid Matrices (mg/kg) :	$\pm$ 35 percent RPD $\pm$ CRDL if result < 5 times CRDL

where RPD is relative percent difference between reported duplicate values,
and CRDL is the contract required detection limit. The CRDLs are:

	<u>Aqueous(ug/l)</u>	<u>Solid(mg/kg)*</u>
Arsenic :	10	2
Cadmium :	5	1
Copper :	25	5
Iron :	100	20
Lead :	5	1

TABLE 4
Milltown Downstream Screening Study
Performance Evaluation Sample Results

		ARSENIC				CADMIUM				COPPER				IRON			
		FOUND		TRUE	% R	DQ	FOUND		TRUE	% R	DQ	FOUND		TRUE	% R	DQ	
Total Metals (Solid)																	
Std. Ref. Material	SO-001-P	923.0		917.0	100.7%	N	36.9		45.4	81.3%	N	5860.0		6910.0	84.8%	N	
	LCS 0287																

		LEAD				MANGANESE				ZINC						
		FOUND		TRUE	% R	DQ	FOUND		TRUE	% R	DQ	FOUND		TRUE	% R	DQ
Total Metals (Solid)																
Std. Ref. Material	SO-001-P	LCS 0287	221.0	236.0	93.6%	N	193.0	208.0	92.8%	N	163.0	187.0	87.2%	N		

NOTES: Questionable preparation of SWDS-008 performance evaluation sample in the field.

KEY: N - indicates data not validated

N/A - not available

FOUND is CLP reported value; TRUE is PE/SRM actual mean value

Manganese :	15	3
Zinc :	20	4

* the indicated CRDLs for solid matrices assume 0% moisture

The RPD criteria (± 20 or ± 35) apply unless the reported result is less than 5 times the CRDL, in which case the criterion of $\pm$ the CRDL applies. (That is, for low level reported results near the detection limit, the ± 20 or ± 35 percent criterion does not apply.)

3.1 Milltown Downstream Screening Study (Task 1)

Aqueous surface water field duplicates collected during the Screening Study consisted of split samples for the analysis of total metals, total recoverable metals, and dissolved metals. This type of field duplicate sample provides information concerning the variability associated with the sample preservation, handling, and sample analysis process, but does not provide information concerning inherent variability of the environmental medium being sampled.

Solid matrix field duplicates collected during the Screening Study consisted of collocated duplicate samples for analysis of total metals. These solid samples were also split by size fraction - ("A" less than 63 microns; "B" less than 2 millimeters, greater than 63 microns).

A comparison of the field duplicate sample results for arsenic, cadmium, copper, iron, lead, manganese, and zinc is presented in Table 5. As previously discussed and as indicated in the tables, data from only two of the available QC duplicate sample sets were validated.

Overall, the field duplicate results indicate acceptable precision for all analytes for both aqueous and solid matrices. The data validation process, although applied to only 20 percent of the samples for each matrix, indicates that the laboratories experienced certain problems in the analysis of arsenic and zinc in solid matrices and in the analysis of lead and zinc in the aqueous matrix.

Aqueous Duplicate Analysis --

Arsenic Analyses: Results indicate that the CLP performed within the EPA Functional Guidelines criterion for duplicate RPD for all of the total recoverable (3 of 3), total (4 of 4), and dissolved (4 of 4) arsenic analyses. Note that none of the reported arsenic values exceeded 5 times the CRDL.

Cadmium Analyses: Results indicate that the CLP performed within the EPA Functional Guidelines criterion for duplicate RPD for all of the total recoverable (3 of 3), total (4 of 4), and dissolved (4 of 4) cadmium analyses. Note that none of the reported cadmium values exceeded 5 times the CRDL.

Copper Analyses: Results indicate that the CLP performed within the EPA Functional Guidelines criterion for duplicate RPD for all of the total recoverable (3 of 3), total (4 of 4), and dissolved (4 of 4) copper analyses. Note that only one of the reported copper values (SWMP-14-003) exceeded 5 times the CRDL. However, both validated sample sets indicate laboratory performance problems with respect to detection limit uncertainty.

Iron Analyses: Results indicate that the CLP performed within the EPA Functional Guidelines criterion for duplicate RPD for all of the total recoverable (3 of 3), total (4 of 4), and dissolved (4 of 4) iron analyses.

TABLE 5
Milltown Reservoir Sediment Site Study
Field Duplicate Sample Data

Aqueous (ug/l)		ARSENIC						CADMIUM						COPPER						IRON							
Site	Location	Sample ID	Duplicate ID	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ
Total Recoverable		SWDS-003	SWDS-003-K	3.9	3.9	0.0%*	N	4.2	4.2	0.0%*	N	17.0	17.0	0.0%*	N	28.0	164.0	-141.7%*	N								
E. Missoula		SWMP5-001	SWMP5-001-K	3.9	4.7	-18.6%*	N	4.2	4.2	0.0%*	N	17.0	17.0	0.0%*	N	116.0	107.0	8.1%	N								
Turah		SWMP12-001	SWMP12-001-K	8.0	8.3	-3.7%*	N	3.7	3.7	0.0%*	N	22.0	22.0	0.0%*	N	238.0	169.0	33.9%	N								
Total Metals																											
E. Missoula		SWDS-003	SWDS-003-K	3.2	3.1	3.2%*	N	5.0	5.0	0.0%	N	7.5	6.6	12.8%*	N	173.0	151.0	13.6%	N								
E. Missoula		SWMP14-003	SWMP14-003-K	6.6	8.0	-19.2%*	N	5.0	5.0	0.0%	N	57.1	58.3	-2.1%	N	1380.0	1410.0	-2.2%	N								
Turah		SWMP5-001	SWMP5-001-K	5.7	5.9	-3.4%*	N	5.5	5.0	9.1%*	N	8.9	6.0	38.9%*	N	87.6	87.6	0.0%*	N								
Turah		SWMP12-001	SWMP12-001-K	5.6	6.4	-13.3%*		5.0	5.0	0.0%		12.6	10.9	14.5%*	JQ	182.0	171.0	6.2%									
Dissolved Metals																											
E. Missoula		SWDS-003	SWDS-003-K	3.0	2.9	3.4%*	N	5.0	5.0	0.0%	N	6.0	6.0	0.0%*	N	56.0	56.0	0.0%	N								
E. Missoula		SWMP14-003	SWMP14-003-K	3.7	5.0	-29.9%*	N	5.0	5.0	0.0%	N	6.0	6.0	0.0%*	N	66.5	77.6	-15.4%*	N								
Turah		SWMP5-001	SWMP5-001-K	4.6	4.9	-6.3%*	N	5.0	5.0	0.0%	N	6.0	6.0	0.0%*	N	56.0	56.0	0.0%*	N								
Turah		SWMP12-001	SWMP12-001-K	6.0	6.2	-3.3%*		5.0	5.0	0.0%		6.7	7.6	-12.6%*	JQ	56.0	56.0	0.0%*									
Sediments - mg/kg																											
Bonner		4SD-002-A	4SD-002-KA	3.2	1.8	56.0%*	JS	0.34	0.3	12.5%*		18.0	20.1	-11.0%		10900.0	10700.0	1.9%									
Bonner		4SD-002-B	4SD-002-KB	2.7	4.2	-43.5%*	N	0.24	0.3	-22.2%*	N	16.1	14.1	13.2%	N	10900.0	10800.0	0.9%	N								

TABLE 5 - Cont'd
Milltown Reservoir Sediment Site Study
Field Duplicate Sample Data

Aqueous (ug/l)		LEAD										MANGANESE										ZINC									
		Sample ID	Duplicate ID	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2	RPD	DQ
Total Recoverable		SWDS-003	SWDS-003-K	2.6	0.9	97.1%*	N	25.8	35.7	-32.2%	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N
E. Missoula		SWMP5-001	SWMP5-001-K	1.0	2.4	-86.6%*	N	9.5	15.0	-44.9%*	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N	11.0	11.0	0.0%*	N
Turah		SWMP12-001	SWMP12-001-K	1.3	1.6	-20.7%*	N	32.2	25.8	22.1%	N	22.7	22.7	42.8%	N	22.7	22.7	42.8%	N	22.7	22.7	42.8%	N	22.7	22.7	42.8%	N	22.7	22.7	42.8%	N
Total Metals																															
E. Missoula		SWDS-003	SWDS-003-K	2.0	2.5	-22.2%*	N	35.5	34.8	2.0%	N	11.2	11.2	-71.6%*	N	11.2	11.2	-71.6%*	N	11.2	11.2	-71.6%*	N	11.2	11.2	-71.6%*	N	11.2	11.2	-71.6%*	N
E. Missoula		SWMP14-003	SWMP14-003-K	5.3	7.8	-38.2%	N	150.0	152.0	-1.3%	N	110.0	110.0	5.6%	N	110.0	110.0	5.6%	N	110.0	110.0	5.6%	N	110.0	110.0	5.6%	N	110.0	110.0	5.6%	N
Turah		SWMP5-001	SWMP5-001-K	3.5	4.4	-22.8%*	N	17.7	18.0	-1.7%	N	17.1	17.1	52.4%*	N	17.1	17.1	52.4%*	N	17.1	17.1	52.4%*	N	17.1	17.1	52.4%*	N	17.1	17.1	52.4%*	N
Turah		SWMP12-001	SWMP12-001-K	2.7	3.9	-36.4%*	J*	35.6	29.4	19.1%	J*	22.9	22.9	12.0%	J*,B,Q	22.9	22.9	12.0%	J*,B,Q	22.9	22.9	12.0%	J*,B,Q	22.9	22.9	12.0%	J*,B,Q	22.9	22.9	12.0%	J*,B,Q
Dissolved Metals																															
E. Missoula		SWDS-003	SWDS-003-K	2.0	2.0	0.0%*	N	20.0	21.3	-6.5%	N	9.8	9.8	80.0%*	N	9.8	9.8	80.0%*	N	9.8	9.8	80.0%*	N	9.8	9.8	80.0%*	N	9.8	9.8	80.0%*	N
E. Missoula		SWMP14-003	SWMP14-003-K	2.0	3.7	-59.6%*	N	75.9	77.0	-1.4%	N	12.5	12.5	24.2%*	N	12.5	12.5	24.2%*	N	12.5	12.5	24.2%*	N	12.5	12.5	24.2%*	N	12.5	12.5	24.2%*	N
Turah		SWMP5-001	SWMP5-001-K	5.8	3.0	63.6%*	N	10.9	7.6	35.7%*	N	21.9	21.9	111.7%*	N	21.9	21.9	111.7%*	N	21.9	21.9	111.7%*	N	21.9	21.9	111.7%*	N	21.9	21.9	111.7%*	N
Turah		SWMP12-001	SWMP12-001-K	2.0	2.0	0.0%*	UJ*	10.2	8.8	14.7%*	UJ*	15.1	15.1	14.2%*	J*,B,Q	15.1	15.1	14.2%*	J*,B,Q	15.1	15.1	14.2%*	J*,B,Q	15.1	15.1	14.2%*	J*,B,Q	15.1	15.1	14.2%*	J*,B,Q
Sediments mg/kg																															
Bonner		4SD-002-A	4SD-002-KA	12.4	17.1	-31.9%		240.0	226.0	6.0%		44.9	44.9	3.4%	JE	44.9	44.9	3.4%	JE	44.9	44.9	3.4%	JE	44.9	44.9	3.4%	JE	44.9	44.9	3.4%	JE
Bonner		4SD-002-B	4SD-002-KB	5.6	6.1	-8.5%	N	143.0	127.0	11.9%	N	31.8	31.8	-0.3%	N	31.8	31.8	-0.3%	N	31.8	31.8	-0.3%	N	31.8	31.8	-0.3%	N	31.8	31.8	-0.3%	N

NOTES: Only one of two Bonner sample duplicates (4SD-002-KA, not 4SD-002-KB) validated

KEY: N - not validated

* - indicates acceptable precision criterion of < 5 times the CRDL is applicable

JQ - value estimated due to detection limit uncertainty

J* - value estimated due to duplicate precision problems

UJ* - undetected value, estimated due to duplicate precision problems

JS - value estimated due to matrix spike recovery problems (matrix interference)

JE - value estimated due to interference problems

J*,B,Q - value estimated due to duplicate precision problems, lab blank contamination, detection limit uncertainty

Lead Analyses: Results indicate that the CLP performed within the EPA Functional Guidelines criterion for duplicate RPD for all of the total recoverable (3 of 3) and dissolved (4 of 4) copper analyses, and for most of the total lead (3 of 4) analyses. However, those duplicate sample sets for which data validation was performed indicate that the CLP laboratories experienced difficulties in the analysis (duplicate precision problems).

Manganese Analyses: Results indicate that the CLP performed within the EPA Functional Guidelines criterion for duplicate RPD for most of the total recoverable (2 of 3), and all of the total (4 of 4), and dissolved (4 of 4) manganese analyses.

Zinc Analyses: Results indicate that the CLP performed within the EPA Functional Guidelines criterion for duplicate RPD for all of the dissolved (4 of 4) zinc analyses, and for most of the total recoverable (2 of 3) and total zinc (3 of 4) analyses. However, those duplicate sample sets for which data validation was performed indicate that the CLP laboratories experienced difficulties in the analysis (duplicate precision, lab blank contamination, and detection limit uncertainty).

Solid Matrix Duplicate Analysis --

Arsenic Analyses: One of two of the duplicate sets for each grain size fraction analyzed for arsenic exceeded the EPA Functional Guidelines RPD criterion of +/- 35 percent (the second duplicate set apparently falls within the < 5 times CRDL criterion). Additionally, the duplicate set for which data validation was performed indicates that the laboratory experienced matrix spike recovery problems.

Cadmium Analyses: Both of the duplicate sets for each grain size fraction analyzed were within the applicable EPA Functional Guidelines RPD criterion of < 5 times the CRDL.

Copper Analyses: Both of the duplicate sets for each grain size fraction analyzed were within the applicable EPA Functional Guidelines RPD criterion of the +/- 35 percent.

Iron Analyses: Both of the duplicate sets for each grain size fraction analyzed were within the applicable EPA Functional Guidelines RPD criterion of +/- 35 percent.

Lead Analyses: Both of the duplicate sets for each grain size fraction analyzed were within the applicable EPA Functional Guidelines RPD criterion of +/- 35 percent.

Manganese Analyses: Both of the duplicate sets for each grain size fraction analyzed were within the applicable EPA Functional Guidelines RPD criterion of +/- 35 percent.

Zinc Analyses: Both of the duplicate sets for each size fraction analyzed were within the applicable EPA Functional Guidelines RPD criterion of the +/- 35 percent. However, data validation of one of the sets of field duplicates indicates that the laboratories experienced problems with the analysis (interference problems).

3.2 Milltown Downstream Screening Study (Task 2)

Field duplicates collected during the Downstream Screening Study consisted of collocated duplicate samples of ground water (station C2A), split samples of surface water (log pond station LP), and collocated duplicate sediment (SD-TR4-CK A&B) and collocated duplicate soil (SO-007, SO-025) samples analyzed for total metals. Field duplicate values are presented in Table 6.

Overall, the field duplicate results indicate acceptable precision for all analytes for both aqueous and solid matrices. The data validation process, although applied to only 20 percent of the samples for each matrix, indicates that the laboratories experienced certain problems, described below, particularly in the analysis of cadmium and lead.

Arsenic Analyses: For aqueous duplicate samples, results indicate precision within the applicable EPA Functional Guidelines criterion of < 5 times the CRDL for both sample sets.

For soil duplicate samples, results also indicate that precision was within the applicable EPA Functional Guidelines criterion of +/- 35 percent for both sets of duplicate samples. For sediment duplicate samples, results indicate that one of two (the smaller size fraction, "A") duplicate sets was within the +/- 35 percent criterion.

Cadmium Analyses: Duplicate precision for aqueous samples was within the applicable EPA Functional Guidelines criterion of < 5 times the CRDL for both sample sets.

Duplicate precision for solid sample matrices was essentially within the applicable EPA Functional Guidelines criteria of +/- 35 percent and < 5 times the CRDL for 4 of 4 sample sets. The data validation process indicates that the laboratory experienced detection limit uncertainty with the one set of solid matrix duplicate samples which was validated.

Copper Analyses: Duplicate precision for aqueous samples was within the

TABLE 6 - Cont'd
Milltown Downstream Screening Study
Field Duplicate Sample Data

Site Location	Sample ID	Duplicate ID	LEAD					MANGANESE					ZINC				
			D1	D2	RPD	DQ	JB	D1	D2	RPD	DQ	D1	D2	RPD	DQ	D1	D2
GROUNDWATER																	
C2A	GW-C2A-001	GW-C2A-001-K	1.5	0.87	53.2%*	JB	1.8	1.8	1.8	0.0%*	UJQ	11.7	11.7	0.0%*			
SURFACE WATER																	
Log Pond (LP)	SW-LP-001	SW-LPK-001K	5.2	5.4	-3.8%	N	664.0	649.0	649.0	2.3%	N	124.0	124.0	0.0%	N		
SEDIMENTS																	
Unidentified	SD-TR4-C-A	SD-TR4-CK-A	36.2	32.9	9.6%	N	875.0	824.0	824.0	6.0%	N	676.0	623.0	8.2%	N		
Unidentified	SD-TR6-C-B	SD-TR6-CK-B	23.0	24.7	-7.1%	N	543.0	617.0	617.0	-12.8%	N	470.0	508.0	-7.8%	N		
SOILS																	
Unidentified	SO-007	SO-007-K	11.7	9.9	16.7%		380.0	393.0	393.0	-3.4%		41.3	40.8	1.2%			
Unidentified	SO-025	SO-025-K	16.8	14.8	12.7%	N	390.0	403.0	403.0	-3.3%	N	55.2	55.0	0.4%	N		

KEY: N - Data not validated
 JI - value estimated due to matrix interference problems; possibly biased low
 JQ - value estimated due to detection limit uncertainty
 JB - value estimated due to laboratory blank problems
 UJQ - value estimated due to detection limit uncertainty; possibly low bias

applicable EPA Functional Guidelines criterion of < 5 times the CRDL for both sample sets.

Duplicate precision for solid sample matrices was essentially within the applicable EPA Functional Guidelines criterion of +/- 35 percent for all (4 of 4) sample sets.

Iron Analyses: Duplicate precision for aqueous samples was within the applicable EPA Functional Guidelines criteria of +/- 20 percent and applicable < 5 times the CRDL for both sample sets.

Duplicate precision for solid sample matrices was within the applicable EPA Functional Guidelines criterion of +/- 35 percent for all (4 of 4) sample sets.

Lead Analyses: Duplicate precision for aqueous samples was within the applicable EPA Functional Guidelines criterion of +/- 20 percent for one of two sample sets.

Duplicate precision for solid sample matrices was within the applicable EPA Functional Guidelines criterion of +/- 35 percent for all (4 of 4) sample sets.

Manganese Analyses: Duplicate precision for aqueous samples was within the applicable EPA Functional Guidelines criterion of +/- 20 percent for both sample sets.

Duplicate precision for solid sample matrices was within the applicable EPA Functional Guidelines criterion of +/- 35 percent for all (4 of 4) sample sets.

Zinc Analyses: Duplicate precision for aqueous samples were within the applicable EPA Functional Guidelines criterion of < 5 times the CRDL for both sample sets.

Duplicate precision for solid sample matrices was essentially within the applicable EPA Functional Guidelines criterion of +/- 35 percent for all (4 of 4) sample sets.

Decontamination rinsate blanks consisted of final rinsates of analyte-free water collected from field sampling equipment (scoops, trowels, bailers, etc.) after completion of the washing and decontamination process. Decontamination rinsate blanks provide a measure of the efficiency of the decontamination protocol. Analysis of the decontamination rinsate blanks provides an estimate of the cross-contamination between samples collected consecutively over time due to inadequate cleansing of sampling equipment.

Field blanks consisting of a sample container of analyte-free water transported to the field, poured into sample containers, and sent blind to the laboratory, were also collected. Travel blanks, essentially bottle blanks in this study, of a sample container of analyte-free water transported to the field and remaining unopened during sampling, and sent blind to the laboratory were also collected. These field and travel blanks provide an indication of the likelihood of contamination from inappropriately cleaned sample containers, inadvertently contaminated reagents, and that introduced from ambient atmospheric conditions during sampling.

4.1 Milltown Downstream Screening Study (Task 1)

Table 7 presents results of all field, decontamination rinsate, and travel blanks collected during the Milltown Downstream Screening Study.

The reported results indicate a general lack of sample contamination from ambient atmospheric sources, inappropriately cleaned sample containers, contaminated preservation reagents, and improper or inadequate sampling equipment decontamination procedures. The majority of reported results are at the instrument or contract required detection limits. The quality or reliability of the relatively infrequent values above the reported detection limits cannot be ascertained.

4.2 Milltown Downstream Screening Study (Task 2)

Table 8 presents results of all field and travel blanks collected during the Milltown Downstream Screening Study. None of these QC data were validated.

The reported results indicate a lack of sample contamination from ambient atmospheric sources, inappropriately cleaned sample containers, contaminated preservation reagents, and improper or inadequate sampling equipment decontamination procedures. (All reported results, except one apparently aberrant zinc and one copper value in sample GW-C2AM-001, were at the reported detection limits.)

4.3 Size Fraction Split Sample Results

Table 9 presents split sample results for the less than 63 micron ("A") and between 63 micron and 2 millimeter ("B") grain size fractions of collected sediment samples. Results indicate a relatively greater concentration of metals in the smaller ("A", less than 63 microns) grain size fraction.

TABLE 7
Milltown Reservoir Sediment Site Study
Field Blank, Travel Blank, Decontamination Rinsate Blank Sample Results

TOTAL RECOVERABLE METALS																		
SITE_NAME	SAMPLE_NO	QA_QC	ITR_#	DATE	AS	DQ	CD	DQ	CU	DQ	FE	DQ	PB	DQ	MN	DQ	ZN	DQ
E. MISSOULA	SWMP3-003-M	M		29-Jun-88	3.9		4.2		17.0		59.1		0.9		9.3		11.0	
E. MISSOULA	SWMP4-003-N	N		30-Jun-88	3.9		4.2		17.0		57.0		0.9		9.3		11.0	
E. MISSOULA	SWMP5-003-N	N		01-Jul-88	3.9		4.2		17.0		84.0		2.0		9.3		11.0	
E. MISSOULA	SWMP6-003-N	N		02-Jul-88	3.9		3.7	U, J, S	22.0		30.0		0.9	J, S	9.6		39.9	
E. MISSOULA	SWMP7-003-N	N		03-Jul-88	3.9		3.7	U, J, S	22.0		30.0		2.7	J, S	6.1		12.0	
E. MISSOULA	SWMP8-003-N	N		04-Jul-88	3.9		3.7	U, J, S	22.0		194.0		1.0	J, S	6.1		12.0	
E. MISSOULA	SWMP9-003-M	M		05-Jul-88	3.9		3.7	U, J, S	22.0		30.6		0.9	J, S	6.1		12.0	
E. MISSOULA	SWMP9-003-N	N		05-Jul-88	3.9		3.7	U, J, S	22.0		75.6		3.4	J, S	595.0		26.4	
E. MISSOULA	SWMP10-003-N	N		06-Jul-88	3.9		3.7	U, J, S	22.0		30.0		0.9	J, S	6.1		12.0	
E. MISSOULA	SWMP11-003-N	N		07-Jul-88	3.9		3.7	U, J, S	22.0		30.0		0.9	J, S	6.1		12.0	
E. MISSOULA	SWMP12-003-N	N		08-Jul-88	3.9		3.7	U, J, S	22.0		37.3		0.9		9.6		12.0	
TURAH	SWMP13-001-M	M		09-Jul-88	3.9		3.7		22.0		35.3		0.9		10.2		12.0	
E. MISSOULA	SWMP13-003-N	N		09-Jul-88	3.9		3.7		22.0		40.1		0.9		7.4		12.0	
TURAH	SWMP14-001-M	M		10-Jul-88	3.9		3.7		22.0		537.0		0.9		10.6		251.0	
E. MISSOULA	SWMP14-003-N	N		10-Jul-88	3.9		3.7		37.0		47.7		0.9		19.8		12.0	
TOTAL METALS																		
SITE_NAME	SAMPLE_NO	QA_QC	ITR_NO	DATE	AS	DQ	CD	DQ	CU	DQ	FE	DQ	PB	DQ	MN	DQ	ZN	DQ
SHUFFIELDS	SWDS-007	N	MHD 978	26-Jun-88	2.0		5.0		9.7		56.0		8.3		7.0		7.4	
SHUFFIELDS	SWDS-008	M	MHD 979	26-Jun-88	2.0		5.0		10.3		56.0		11.1		7.0		7.5	
E. MISSOULA	SWMP2-003-M	M	MHE 332	28-Jun-88	2.0		5.0		6.0		56.0		4.0		7.0		9.8	
E. MISSOULA	SWMP2-003-N	N	MHE 331	28-Jun-88	2.0		5.0		6.0		56.0		7.7		7.0		8.4	
E. MISSOULA	SWMP3-003-M	M	MHG 074	29-Jun-88	2.0		5.0		6.0		56.0		2.4		7.0		7.8	
E. MISSOULA	SWMP4-003-N	N	MHG 155	30-Jun-88	2.0		7.1		6.0		56.0		4.0		7.0		78.9	
E. MISSOULA	SWMP5-003-N	N	MHF 255	01-Jul-88	2.0		5.0		6.0		56.0		17.6		7.0		20.5	
E. MISSOULA	SWMP6-003-N	N	MHF 263	02-Jul-88	2.0		5.0		6.0		56.0		4.8		7.0		5.0	
E. MISSOULA	SWMP7-003-N	N	MHG 097	03-Jul-88	2.0		5.0		12.0		56.0		3.2		7.0		6.0	
E. MISSOULA	SWMP8-003-N	N	MHJ 339	04-Jul-88	2.0		5.0		11.1		56.0		2.0		7.0		7.9	
E. MISSOULA	SWMP9-003-M	M	MHJ 349	05-Jul-88	2.0		5.0		10.1		56.0		4.3	J*	7.0		11.8	JB
E. MISSOULA	SWMP9-003-N	N	MHJ 351	05-Jul-88	2.0		5.0		6.7		56.0		2.2	J*	7.0		7.9	JB
E. MISSOULA	SWMP10-003-N	N	MHJ 365	06-Jul-88	2.0		5.0		8.0		56.0		3.0	J*	7.0		28.3	JB
E. MISSOULA	SWMP11-003-N	N	MHJ 373	07-Jul-88	2.0		5.0		6.0		56.0		2.3	J*	7.0		10.6	J*, B, Q
E. MISSOULA	SWMP12-003-N	N	MHJ 383	08-Jul-88	2.0		5.0		6.0		56.0		6.4	J*	7.0		8.2	J*, B, Q
TURAH	SWMP13-001-M	M	MHJ 385	09-Jul-88	2.0		5.0		12.6	JQ	56.0		5.0	J*	7.0		9.9	J*, B, Q
E. MISSOULA	SWMP13-003-N	N	MHJ 391	09-Jul-88	2.0		5.0		6.0		56.0		2.0		7.0		14.7	
E. MISSOULA	3-SD-003-M	M	MHQ 816	10-Jul-88	2.1		1.7		7.9		265.0		0.8		2.6		26.6	
E. MISSOULA	3-SD-003-N	N	MHQ 817	10-Jul-88	2.1		1.7		7.9		47.1		3.2		2.6		26.6	
E. MISSOULA	SWMP14-003-N	N	MHE 327	10-Jul-88	2.0		5.0		6.7		56.0		3.2		7.0		22.0	
TRAV. BLNK	5-SD-004-M	M	MHQ 833	27-Jul-88	2.1		1.7		7.9		37.0		0.9		2.6		23.5	
DECON	5-SD-004-N	N	MHQ 834	27-Jul-88	2.1		1.7		7.9		58.2		2.7		2.6		27.8	

TABLE 7 - Cont'd
 Milltown Reservoir Sediment Site Study
 Field Blank, Travel Blank, Decontamination Rinsate Blank Sample Results

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DISSOLVED METALS																		

SITE_NAME	SAMPLE_NO	QA_QC	ITR_NO	DATE	AS	DQ	CD	DQ	CU	DQ	FE	DQ	PB	DQ	MN	DQ	ZN	DQ
E. MISSOULA	SWMP2-003-N	N	MHE 331	28-Jun-88	2.0		5.0		6.0		56.0		7.7		7.0		8.4	
E. MISSOULA	SWMP3-003-M	M	MHG 073	29-Jun-88	2.0		5.0		6.0		56.0		5.7		7.0		13.7	
E. MISSOULA	SWMP3-003-N	N	MHG 072	29-Jun-88	2.0		5.0		6.0		56.0		4.1		7.0		4.9	
E. MISSOULA	SWMP4-003-N	N	MHG 154	30-Jun-88	2.0		5.0		6.0		56.0		8.9		7.0		5.2	
E. MISSOULA	SWMP5-003-N	N	MHF 254	01-Jul-88	2.0		5.0		6.0		56.0		3.1		7.0		3.9	
E. MISSOULA	SWMP6-003-N	N	MHF 262	02-Jul-88	2.0		5.0		6.0		56.0		6.9		7.0		5.2	
E. MISSOULA	SWMP7-003-N	N	MHG 096	03-Jul-88	2.0		5.0		11.6		56.0		3.6		7.0		5.0	
E. MISSOULA	SWMP8-003-N	N	MHJ 338	04-Jul-88	2.0		5.0		13.2		56.0		2.0		7.0		8.6	
E. MISSOULA	SWMP9-003-M	M	MHJ 348	05-Jul-88	2.0		5.0		9.5		56.0		3.3		7.0		8.6	
E. MISSOULA	SWMP9-003-N	N	MHJ 350	05-Jul-88	2.0		5.0		9.5		56.0		2.4	J*	7.0		9.8	JB
E. MISSOULA	SWMP10-003-N	N	MHJ 364	06-Jul-88	2.0		5.0		6.0		56.0		3.3	J*	7.0		8.6	JB
E. MISSOULA	SWMP11-003-N	N	MHJ 372	07-Jul-88	2.0		5.0		6.0		56.0		3.0	J*	7.0		12.3	J*,B,Q
E. MISSOULA	SWMP12-003-N	N	MHJ 382	08-Jul-88	2.0		5.0		6.0		56.0		2.0	UJ*	7.0		6.4	J*,B,Q
TURAH	SWMP13-001-M	M	MHJ 384	09-Jul-88	2.0		5.0		12.6	JQ	56.0		2.0	UJ*	7.0		18.4	J*,B,Q
	SWMP13-003-N	N	MHJ 390	09-Jul-88	2.0		5.0		6.0		56.0		2.9		7.0		11.5	
E. MISSOULA	SWMP14-003-N	N	MHJ 400	10-Jul-88	2.0		5.0		6.0		56.0		2.9		7.0		10.0	
=====																		

NOTES: N indicates data not validated

KEY: QA/QC N indicates a decontamination rinsate blank
 QA/QC M indicates an unopened field blank (similar to bottle blank)

JS - value estimated due to matrix spike recovery problems
 JQ - value estimated due to detection limit uncertainty
 JB - value estimated due to blank contamination problems
 JE - value estimated due to serial dilution problem
 J* - value estimated due to duplicate precision problems
 UJ* - reported undetected value estimated due to duplicate precision problems
 J*,B,Q - value estimated due to duplicate precision, blank contamination, and detection limit uncertainty

TABLE 8
Milltown Downstream Screening Study
Field Blank, Travel Blank, Decontamination Rinsate Blank Sample Data

GROUNDWATER																		
SITE_NAME	SAMPLE_NO	QA_QC	ITR_NO	Date	Arsenic	DQ	Cadmium	DQ	Copper	DQ	Iron	DQ	Lead	DQ	Manganese	DQ	Zinc	DQ
C2A LP	GW-C2AM-001	M	MHJ 261	31-Oct-88	1.9		3.1		30.7		22.6		1.1		3.2		57.5	
	GW-C2BN-001	N	MHJ 258	31-Oct-88	1.9		3.1		4.6		22.6		0.8		2.6		11.7	
	SW-LPJ-001	J	MHJ 286	04-Nov-88	1.3		3.1		4.6		22.6		1.6		1.8		11.7	
SEDIMENTS																		
SITE_NAME	SAMPLE_NO	QA_QC	ITR_NO	DATE	AS	DQ	CD	DQ	CU	DQ	FE	DQ	PB	DQ	MN	DQ	ZN	DQ
SD-TR4-AJ SD-TR6-DJ		J	MHJ 283	09-Nov-88	1.3		3.1		4.6		22.6		1.6		1.8		11.7	
		J	MHJ 284	09-Nov-88	1.3		3.1		4.6		22.6		1.6		1.8		11.7	
SOILS																		
SITE_NAME	SAMPLE_NO	QA_QC	ITR_NO	DATE	AS	DQ	CD	DQ	CU	DQ	FE	DQ	PB	DQ	MN	DQ	ZN	DQ
SO-012-J SO-027-J		J	MHJ 247	28-Oct-88	1.3		3.1		4.6		22.6		1.6		1.8		11.7	
		J	MHJ 272	27-Oct-88	1.9		3.1		4.6		32.2		0.8		2.6		11.7	

NOTES: DQ indicates data validation qualifier flag
No data in these sets were validated

KEY: QA_QC J indicates a combined field/decontamination rinsate blank
QA_QC M indicates a travel blank (in this case, a bottle blank)
QA_QC N indicates a decontamination rinsate blank

TABLE 9
Milltown Downstream Screening Study
Size Fraction Split Sample Comparison

=====																		
SEDIMENTS																		

SITE_NAME	SAMPLE_NO	QA_QC	ITR_NO	DATE	AS	DQ	CD	DQ	CU	DQ	FE	DQ	PB	DQ	MN	DQ	ZN	DQ
	SD-TR4-C-A		MHP	321	19-Oct-88	14.9		1.8	153.0		13600.0		36.2		875.0		676.0	
	SD-TR4-C-B		MHQ	707	19-Oct-88	10.1		1.4	98.9		10900.0		23.0		543.0		470.0	
	SD-TR6-C-A		MHP	338	20-Oct-88	36.2		2.9	275.0		14300.0		58.1		1100.0		1110.0	
	SD-TR6-C-B		MHQ	724	20-Oct-88	24.8		1.9	212.0		12100.0		40.6		769.0		766.0	
=====																		

NOTES: DQ indicates data validation qualifier flag
No data in these sets were validated

KEY: QA_QC J indicates a combined field/decontamination rinsate blank
QA_QC M indicates a travel blank (in this case, a bottle blank)
QA_QC N indicates a decontamination rinsate blank

APPENDIX 5.2

FIELD AND ANALYTICAL DATA

APPENDIX 5.2

FIELD AND ANALYTICAL DATA

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(U) = Undetected but estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (U-S)

Meaning the reported (200u) is estimated (U)
due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be
flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J)
due to spike recovery problems (-S).

C. Inorganic Analysis Data Sheet [FORM I-IN]

This form is used to tabulate and report sample analysis results for target analytes (Exhibit C).

Complete the header information according to the instructions in Part A and as follows.

"Date Received" is the date (formatted MM/DD/YY) of sample receipt at the laboratory, as recorded on the Traffic Report, i.e., the Validated Time of Sample Receipt (VTSR).

"% Solids" is the percent of solids on a weight/weight basis in the sample as determined by drying the sample as specified in Exhibit D. Report percent solids to one decimal place (i.e., 5.3%). If the percent solids is not required because the sample is fully aqueous or less than 1% solids, then enter "0" (zero).

Enter the appropriate concentration units (UG/L for water or MG/KG dry weight for soil). Entering "MG/KG" means "mg/Kg dry weight" on this form.

Under the column labeled "Concentration", enter for each analyte either the value of the result (if the concentration is greater than or equal to the Instrument Detection Limit) or the Instrument Detection Limit for the analyte corrected for any dilutions (if the concentration is less than the Instrument Detection Limit).

Under the columns labeled "C", "Q", and "M", enter result qualifiers as identified below. If additional qualifiers are used, their explicit definitions must be included on the Cover Page in the Comments section.

FORM I-IN includes fields for three types of result qualifiers. These qualifiers must be completed as follows:

- o C (Concentration) qualifier -- Enter "B" if the reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" must be entered.
- o Q qualifier -- Specified entries and their meanings are as follows:
 - E - The reported value is estimated because of the presence of interference. An explanatory note must be included under Comments on the Cover Page (if the problem applies to all samples) or on the specific FORM I-IN (if it is an isolated problem).
 - M - Duplicate injection precision not met.
 - N - Spiked sample recovery not within control limits.
 - S - The reported value was determined by the Method of Standard Additions (MSA).

- W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance. (See Exhibit E.)
- * - Duplicate analysis not within control limits.
- + - Correlation coefficient for the MSA is less than 0.995.

Entering "S", "W", or "+" is mutually exclusive. No combination of these qualifiers can appear in the same field for an analyte.

o M (Method) qualifier -- Enter:

- "P" for ICP
- "A" for Flame AA
- "F" for Furnace AA
- "CV" for Manual Cold Vapor AA
- "AV" for Automated Cold Vapor AA
- "AS" for Semi-Automated Spectrophotometric
- "C" for Manual Spectrophotometric
- "T" for Titrimetric
- "NR" if the analyte is not required to be analyzed.

A brief physical description of the sample, both before and after digestion, must be reported in the fields for color (before and after), clarity (before and after), texture and artifacts. For water samples, report color and clarity. For soil samples, report color, texture and artifacts.

The following descriptive terms are recommended:

- | | |
|---------|--|
| Color | - red, blue, yellow, green, orange, violet, white, colorless, brown, grey, black |
| Clarity | - clear, cloudy, opaque |
| Texture | - fine (powdery), medium (sand), coarse (large crystals or rocks) |

If artifacts are present, enter "YES" in the artifacts field and describe the artifacts in the Comments field. If artifacts are not present, leave this field blank.

Note any significant changes that occur during sample preparation (i.e., emulsion formation) in the Comments field. Enter any sample-specific comments concerning the analyte results in the Comments field.

D. Initial and Continuing Calibration Verification [FORM II(PART 1)-IN]

This form is used to report analyte recoveries from calibration solutions.

Complete the header information according to the instructions in Part A and as follows.

Enter the Initial Calibration Source (12 spaces maximum) and the Continuing Calibration Source (12 spaces maximum). Enter "EPA-LV" or

APPENDIX 5.2.1

RESERVOIR DRAWDOWN RAW DATA

FIELD SAMPLING PARAMETERS

SITE NAME	LOCID	ITR NO	ITR NO2	ITR NO3	ITR NO4	SAMPLE ID	STIE NO	CC CODE	DEP	CC CODE2	DE DATE	SC	DO	PH	AIR TEMP	H2O TEMP	FLOW CFS
TURPIN	SMP5-001	MHD 338	MHD 337			SMP5					06/26/88	185.00	1.70	7.60	26.00	18.00	0.00
PONNER	SMP5-002	MHD 342	MHD 341			SMP5					06/26/88	182.00	0.90	7.60	23.00	20.00	0.00
E. MISSOURIA	SMP5-003	MHD 344	MHD 343			SMP5					06/26/88	228.00	0.00	7.40	26.50	21.00	0.00
E. MISSOURIA	SMP5-003-K	MHD 345	MHD 345			SMP5			DUNE		06/26/88	273.00	0.00	7.40	26.50	21.00	0.00
HELLGATE	SMP5-004	MHD 346	MHD 347			SMP5					06/26/88	230.00	0.00	7.40	26.00	22.00	0.00
U. BRIDGE	SMP5-005	MHD 350	MHD 349			SMP5					06/26/88	220.00	0.00	7.75	33.00	23.00	0.00
RESERVE ST.	SMP5-006	MHD 975	MHD 974			SMP5					06/26/88	220.00	0.00	7.60	28.30	23.00	0.00
SHUFFIELDS	SMP5-007	MHD 977	MHD 978 N	MHD 976		SMP5			DOWN		06/26/88	222.00	0.00	7.80	21.50	22.00	0.00
SHUFFIELDS	SMP5-008	MHD 979 N	MHD 980 F	MHD 981 F		SMP5			TRAV	F	06/26/88	0.00	0.00	0.00	0.00	0.00	0.00
TURPIN	SMP2-001	MHD 983	MHD 982			SMP2	1				06/27/88	252.00	0.00	8.10	25.00	19.00	0.00
TURPIN	SMP5-001	MHD 985	MHD 984			SMP5	1				06/27/88	252.00	0.00	8.10	25.00	19.00	0.00
TURPIN	SMP5-001-K					SMP5	1		DUNE		06/27/88	252.00	0.00	8.10	25.00	19.00	0.00
PONNER	SMP2-002	MHD 989	MHD 988			SMP2	2				06/27/88	185.00	0.00	8.50	22.00	21.00	0.00
PONNER	SMP5-002	MHD 987	MHD 986			SMP5	2				06/27/88	185.00	0.00	8.50	22.00	21.00	0.00
E. MISSOURIA	SMP2-003	MHD 991	MHD 992 N	MHD 993 N	MHD 990	SMP2	3		TRAV	N	06/27/88	225.00	0.00	8.00	25.00	20.00	0.00
E. MISSOURIA	SMP5-003	MHD 995	MHD 994			SMP5	3				06/27/88	225.00	0.00	8.00	25.00	20.00	0.00
TURPIN	SMP2-001	MHD 997	MHD 996			SMP2	1				06/28/88	252.00	0.00	8.10	21.50	18.50	0.00
PONNER	SMP2-002	MHD 999	MHD 998			SMP2	2				06/28/88	200.00	0.00	8.15	23.50	20.00	0.00
E. MISSOURIA	SMP2-003	MHE 330	MHE 329			SMP2	3				06/28/88	265.00	0.00	8.10	28.00	19.00	0.00
TURPIN	SMP3-001	MHE 334	MHE 333			SMP2	1				06/29/88	240.00	11.60	7.90	12.50	14.50	0.00
PONNER	SMP3-002	MHE 336	MHE 335			SMP3	2				06/29/88	184.00	12.60	7.90	13.50	16.00	0.00
E. MISSOURIA	SMP3-003	MHE 071	MHE 070			SMP2	3				06/29/88	219.00	10.20	7.90	13.00	17.00	0.00
E. MISSOURIA	SMP3-003-K					SMP3	3		DOWN		06/29/88	0.00	0.00	0.00	0.00	0.00	0.00
E. MISSOURIA	SMP5-003-N	MHE 074	MHE 073			SMP3	3		TRAV		06/29/88	0.00	0.00	0.00	0.00	0.00	0.00
TURPIN	SMP4-001	MHE 076	MHE 075			SMP4	1				06/30/88	230.00	14.60	8.20	13.00	13.00	0.00
PONNER	SMP4-002	MHE 151	MHE 077			SMP4	2				06/30/88	194.00	11.40	8.20	20.00	16.00	0.00
E. MISSOURIA	SMP4-003	MHE 153	MHE 152			SMP4	3				06/30/88	215.00	10.60	8.30	25.50	16.00	0.00
E. MISSOURIA	SMP4-003-K	MHE 155	MHE 154			SMP4	3		DOWN		06/30/88	0.00	0.00	0.00	0.00	0.00	0.00
TURPIN	SMP5-001	MHE 157	MHE 156			SMP5	1				07/01/88	246.00	11.40	8.30	18.00	15.00	0.00
PONNER	SMP5-001-K	MHE 159	MHE 158			SMP5	1		DUNE		07/01/88	243.00	11.40	8.30	18.00	15.00	0.00
PONNER	SMP5-002	MHE 251	MHE 160			SMP5	002				07/01/88	150.00	13.20	8.30	21.00	17.50	0.00
E. MISSOURIA	SMP5-003	MHE 253	MHE 252			SMP5	1				07/01/88	220.00	11.20	8.20	28.00	17.00	0.00
E. MISSOURIA	SMP5-003-K	MHE 255	MHE 254			SMP5	3		DOWN		07/01/88	0.00	0.00	0.00	0.00	0.00	0.00
TURPIN	SMP6-001	MHE 257	MHE 256			SMP6	1				07/02/88	250.00	14.20	7.60	15.00	16.00	0.00
PONNER	SMP6-002	MHE 259	MHE 258			SMP6	2				07/02/88	170.00	10.20	7.50	17.00	18.00	0.00
E. MISSOURIA	SMP6-003	MHE 261	MHE 260			SMP6	3				07/02/88	218.00	10.00	7.81	23.00	20.00	0.00

FIELD SAMPLING PARAMETERS

SITE NAME	LOCID	ITR NO	ITR NO2	ITR NO3	ITR NO4	SAMPLE ID	NO QC	DATE	DO	PH	AIR TEMP	H2O TEMP	FLOW CFE
E. MISSOULA	SAMP6-003-N	NHJ 263	NHJ 262			SAMP6	3	07/02/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP7-001	NHJ 265	NHJ 264			SAMP7	1	07/03/88	9.20	8.00	20.00	17.00	0.00
BONNER	SAMP7-002	NHJ 093	NHJ 092			SAMP7	2	07/03/88	16.40	8.10	18.00	18.00	0.00
E. MISSOULA	SAMP7-003	NHJ 095	NHJ 094			SAMP7	3	07/03/88	9.20	8.20	22.00	20.00	0.00
E. MISSOULA	SAMP7-003-N	NHJ 097	NHJ 096			SAMP7	3	07/03/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP8-001	NHJ 099	NHJ 098			SAMP8	1	07/04/88	13.60	8.00	19.00	17.00	0.00
BONNER	SAMP8-002	NHJ 337	NHJ 336			SAMP8	2	07/04/88	8.10	8.30	21.00	18.00	0.00
E. MISSOULA	SAMP8-003	NHJ 337	NHJ 336			SAMP8		07/04/88	230.00	8.15	24.00	20.00	0.00
E. MISSOULA	SAMP8-003-N	NHJ 339	NHJ 338			SAMP8	3	07/04/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP9-001	NHJ 343	NHJ 342			SAMP9	1	07/05/88	8.60	8.10	19.00	17.00	0.00
BONNER	SAMP9-002	NHJ 345	NHJ 344			SAMP9	2	07/05/88	8.20	8.20	18.50	18.00	0.00
E. MISSOULA	SAMP9-003	NHJ 347	NHJ 346			SAMP9	3	07/05/88	8.30	8.10	21.00	19.00	0.00
E. MISSOULA	SAMP9-003-N	NHJ 349	NHJ 348			SAMP9	3	07/05/88	0.00	0.00	0.00	0.00	0.00
E. MISSOULA	SAMP9-003-N	NHJ 351	NHJ 350			SAMP9	3	07/05/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP10-001	NHJ 353	NHJ 352			SAMP10	1	07/06/88	8.40	8.00	15.00	15.00	0.00
TURAH	SAMP10-001	NHJ 355	NHJ 354			SAMP10	1	07/06/88	8.40	8.00	15.00	15.00	0.00
BONNER	SAMP10-002	NHJ 357	NHJ 356			SAMP10	2	07/06/88	8.90	8.10	15.00	15.00	0.00
BONNER	SAMP10-002	NHJ 359	NHJ 358			SAMP10	2	07/06/88	8.80	8.10	15.00	15.00	0.00
E. MISSOULA	SAMP10-003	NHJ 361	NHJ 360			SAMP10	3	07/06/88	8.60	8.00	15.00	15.50	0.00
E. MISSOULA	SAMP10-003	NHJ 363	NHJ 362			SAMP10	3	07/06/88	8.60	8.00	15.00	15.50	0.00
E. MISSOULA	SAMP10-003-N	NHJ 365	NHJ 364			SAMP10	3	07/06/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP11-001	NHJ 367	NHJ 366			SAMP11	1	07/07/88	8.60	7.80	9.00	12.50	0.00
BONNER	SAMP11-002	NHJ 369	NHJ 368			SAMP11	2	07/07/88	8.90	8.20	15.00	15.00	0.00
E. MISSOULA	SAMP11-003	NHJ 371	NHJ 370			SAMP11	3	07/07/88	8.60	8.10	18.00	16.00	0.00
E. MISSOULA	SAMP11-003-N	NHJ 373	NHJ 372			SAMP11	3	07/07/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP12-001	NHJ 375	NHJ 374			SAMP12	1	07/08/88	8.20	8.10	18.00	15.00	0.00
TURAH	SAMP12-001-N	NHJ 377	NHJ 376			SAMP12	1	07/08/88	8.20	8.10	18.00	15.00	0.00
BONNER	SAMP12-002	NHJ 379	NHJ 378			SAMP12	2	07/08/88	8.70	8.20	22.00	18.00	0.00
E. MISSOULA	SAMP12-003	NHJ 381	NHJ 380			SAMP12	3	07/08/88	8.80	8.10	26.00	18.00	0.00
E. MISSOULA	SAMP12-003-N	NHJ 383	NHJ 382			SAMP12	3	07/08/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP13-001	NHJ 385	NHJ 384			SAMP13	1	07/09/88	8.20	8.10	19.00	15.00	0.00
TURAH	SAMP13-001-N	NHJ 387	NHJ 386			SAMP13	1	07/09/88	0.00	0.00	0.00	0.00	0.00
BONNER	SAMP13-002	NHJ 389	NHJ 388			SAMP13	2	07/09/88	8.20	8.10	22.00	19.00	0.00
E. MISSOULA	SAMP13-003	NHJ 389	NHJ 388			SAMP13	3	07/09/88	8.10	8.10	25.00	18.50	0.00
E. MISSOULA	SAMP13-003-N	NHJ 391	NHJ 390			SAMP13	3	07/09/88	0.00	0.00	0.00	0.00	0.00
TURAH	SAMP14-001	NHJ 393	NHJ 392			SAMP13	1	07/10/88	7.90	8.00	16.00	15.50	0.00

FIELD SAMPLING PARAMETERS

SITE NAME	LOCAL	ITR NO	ITR NO2	ITR NO3	ITR NO4	SAMPLE ID	SITE NO	SC CODE	DEF	OC	DATE	SC	DO	PH	AIR TEMP	H2O TEMP	FLOW	CFS
DEWEER	SUMP14-002	MHD 395	MHD 394			SUMP14	2				07/10/88	192.00	8.00	8.20	21.00	18.00	0.00	0.00
E. MISSOULA	SUMP14-003	MHD 397	MHD 396			SUMP14	3				07/10/88	240.00	7.70	8.10	24.00	19.00	0.00	0.00
E. MISSOULA	SUMP14-002-K	MHD 399	MHD 398			SUMP14	3	K	DUFF		07/10/88	240.00	7.70	8.10	24.00	19.00	0.00	0.00
E. MISSOULA	SUMP14-003-W	MHE 327	MHD 400			SUMP14	3	H	DOOR		07/10/88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. MISSOULA	SUMP2-003-R		MHE 331			SUMP2	3	H	DOOR		06/28/88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. MISSOULA	SUMP2-003-M	MHE 332				SUMP2	3	H	TRAW		06/28/88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TURF	1-5D-001-A	MHD 801				1-5D	1				06/27/88	252.00	0.00	8.10	25.00	19.00	0.00	0.00
TURF	1-5D-001-B	MHD 802				1-5D	1				06/27/88	252.00	0.00	8.10	25.00	19.00	0.00	0.00
DEWEER	1-5D-002-A	MHD 803				1-5D	2				06/27/88	185.00	0.00	8.50	22.00	21.00	0.00	0.00
DEWEER	1-5D-002-B	MHD 804				1-5D	2				06/27/88	185.00	0.00	8.50	22.00	21.00	0.00	0.00
E. MISSOULA	1-5D-003-A	MHD 805				1-5D	3				06/27/88	185.00	0.00	8.50	22.00	21.00	0.00	0.00
E. MISSOULA	1-5D-003-B	MHD 806				1-5D	3				06/27/88	225.00	0.00	8.00	25.00	20.00	0.00	0.00
TURF	2-5D-001-A	MHD 807				2-5D	1				07/06/88	250.00	8.40	8.00	15.00	15.00	0.00	0.00
TURF	2-5D-001-B	MHD 808				2-5D	1				07/06/88	250.00	8.40	8.00	15.00	15.00	0.00	0.00
DEWEER	2-5D-002-A	MHD 809				2-5D	2				07/06/88	150.00	8.90	8.10	15.00	15.00	0.00	0.00
DEWEER	2-5D-002-B	MHD 810				2-5D	2				07/06/88	150.00	8.80	8.10	15.00	15.00	0.00	0.00
E. MISSOULA	2-5D-003-A	MHD 811				2-5D	3				07/06/88	240.00	8.60	8.00	15.00	15.50	0.00	0.00
E. MISSOULA	2-5D-003-B	MHD 812				2-5D	3				07/06/88	240.00	8.60	8.00	15.00	15.50	0.00	0.00
STP REF	2-5D-004-A	MHD 813				2-5D	4				07/06/88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. MISSOULA	3-5D-002-A	MHD 814				3-5D	3				07/10/88	240.00	7.70	8.10	24.00	19.00	0.00	0.00
E. MISSOULA	3-5D-003-B	MHD 815				3-5D	3				07/06/88	240.00	7.70	8.10	24.00	19.00	0.00	0.00
TRAIL BLK	3-5D-002-W	MHD 816				3-5D	3	H	TRAP		07/10/88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DEWEER	3-5D-003-W	MHD 817				3-5D	3	H	DOOR		07/10/88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TURF	4-5D-001-A	MHD 818				4-5D	1				07/25/88	292.00	10.20	8.20	31.00	22.00	0.00	0.00
TURF	4-5D-001-B	MHD 819				4-5D	1				07/25/88	292.00	10.20	8.20	31.00	22.00	0.00	0.00
DEWEER	4-5D-002-A	MHD 820				4-5D	2				07/25/88	210.00	11.40	8.30	34.00	23.00	0.00	0.00
DEWEER	4-5D-002-B	MHD 821				4-5D	2				07/25/88	210.00	11.40	8.30	34.00	23.00	0.00	0.00
DEWEER	4-5D-002-A	MHD 822				4-5D	2	I	DUFF		07/25/88	210.00	11.40	8.30	34.00	23.00	0.00	0.00
DEWEER	4-5D-002-B	MHD 823				4-5D	2	I	DUFF		07/25/88	210.00	11.40	8.30	34.00	23.00	0.00	0.00
E. MISSOULA	4-5D-003-A	MHD 824				4-5D	3				07/25/88	258.00	8.30	8.10	35.00	23.00	0.00	0.00
E. MISSOULA	4-5D-003-B	MHD 825				4-5D	3				07/25/88	258.00	8.30	8.10	35.00	23.00	0.00	0.00
TURF	5-5D-001-A	MHD 826				5-5D	1				07/27/88	260.00	8.00	8.10	19.00	19.00	0.00	0.00
TURF	5-5D-001-B	MHD 827				5-5D	1				07/27/88	260.00	8.00	8.10	19.00	19.00	0.00	0.00
DEWEER	5-5D-002-A	MHD 828				5-5D	2				07/27/88	205.00	8.10	8.30	0.00	20.00	0.00	0.00
DEWEER	5-5D-002-B	MHD 829				5-5D	2				07/27/88	205.00	8.10	8.20	0.00	20.00	0.00	0.00
E. MISSOULA	5-5D-002-A	MHD 830				5-5D	3				07/27/88	275.00	8.20	8.20	0.00	22.00	0.00	0.00

FIELD SAMPLING PARAMETERS

SITE NAME	LOCID	ITR NO	ITR NO2	ITR NO3	ITR NO4	SAMPLE ID	SITE NO	QC CODE	RC DEF	QC CODE	DEF DATE	SC	DO	PH	AIR TEMP	H2O TEMP	FLOW	DFS
E. MIDDLE	5-50-003-B	WHD 831				5-50	3				07/27/88	275.00	8.20	8.20	0.00	22.00	0.00	
STE REF	5-50-004-A	WHD 832				5-50	4				07/27/88	0.00	0.00	0.00	0.00	0.00	0.00	
TRAW. BUR	5-50-004-M	WHD 833				5-50	4	M	TRAW		07/27/88	0.00	0.00	0.00	0.00	0.00	0.00	
DECON	5-50-004-W	WHD 834				5-50	4	W	DECON		07/27/88	0.00	0.00	0.00	0.00	0.00	0.00	

TOTAL METALS --- MILLION

SITE NAME	SAMPLE NO	ITR NO	DATE	AL AL OUNL	SP SP OUNL	AS AS OUNL	SA SA OUNL	BE BE OUNL	DD CD OUNL	CR CR OUNL
CF TURAH	SWDS-001	MHD 333	06/26/88	114.00	29.30 U	4.60	86.50	1.00 U	5.00 U	36600.00
ROMNER	SWDS-002	MHD 342	06/26/88	76.10	29.60 U	2.00 U	192.00	1.00 U	5.00 U	28500.00
E. MISSOULA	SWDS-003	MHD 344	06/26/88	117.00	29.60 U	3.20	137.00	1.00 U	5.00 U	31500.00
E. MISSOULA	SWDS-003-K	MHD 345	06/26/88	87.80	29.60 U	3.10	146.00	1.00 U	5.00 U	32500.00
HELLGATE	SWDS-004	MHD 348	06/26/88	107.00	29.60 U	3.00	135.00	1.00 U	5.00 U	31500.00
U. RESERVE	SWDS-005	MHD 350	06/26/88	102.00	29.60 U	3.20	137.00	1.00 U	5.00 U	32500.00
RESERVE ST.	SWDS-006	MHD 375	06/26/88	95.00	29.60 U	2.60 U	120.00	1.00 U	5.00 U	30400.00
SHUFFIELDS	SWDS-007	MHD 377	06/26/88	79.20	29.60 U	2.00	133.00	1.00 U	5.00 U	31400.00
SHUFFIELDS	SWDS-007	MHD 378	06/26/88	35.00 U	29.60 U	2.00 U	2.00 U	1.00 U	5.00 U	106.00
SHUFFIELDS	SWDS-008	MHD 379	06/26/88	35.00 U	29.60 U	2.00 U	2.00 U	1.00 U	5.00 U	68.30
SHUFFIELDS	SWDS-008	MHD 980	06/26/88	35.00 U	29.60 U	74.70 S	502.00	1.00 U	223.00	26000.00
SHUFFIELDS	SWDS-009	MHD 981	06/26/88	35.00 U	29.60 U	36.10	761.00	1.00 U	118.00	13400.00
TURAH	1-S0-001-A	MHD 801	06/27/88	12800.00 #	0.71 URM /JIS	29.20	272.00 #	0.15 U#	1.60 #	33800.00 #
TURAH	1-S0-001-P	MHD 802	06/27/88	8040.00	0.93 URM	12.80	121.00	0.13 U	1.00	16500.00
ROMNER	1-S0-002-A	MHD 803	06/27/88	11100.00	0.68 URM /JIS	5.50	416.00 #	0.51 #	0.32 U#	45200.00 #
ROMNER	1-S0-002-B	MHD 804	06/27/88	10100.00	0.67 U RM	5.20	357.00	0.33	0.27 U	53700.00
E. MISSOULA	1-S0-003-A	MHD 805	06/27/88	10700.00 #	0.70 URM /JIS	12.50	391.00 #	0.45 #	1.80 #	19200.00 #
E. MISSOULA	1-S0-003-B	MHD 806	06/27/88	4320.00	0.62 U R	5.90	70.60	0.12 U	0.35	2460.00
TURAH	SWDS-001	MHD 985	06/27/88	71.30	29.60 U	0.00	91.50	1.00 U	5.00 U	40100.00
ROMNER	SWDS-002	MHD 987	06/27/88	50.50	29.60 U	2.00 U	202.00	1.00 U	5.00 U	30900.00
E. MISSOULA	SWDS-003	MHD 995	06/27/88	96.60	29.60 U	3.10	147.00	1.00 U	5.00 U	35900.00
TURAH	SWDP-001	MHD 983	06/27/88	56.50	29.60 U	5.30	99.20	1.00 U	5.00 U	39200.00
ROMNER	SWDP-002	MHD 989	06/27/88	43.30	29.60 U	2.30 U	199.00	1.00 U	5.00 U	30400.00
E. MISSOULA	SWDP-005	MHD 993	06/27/88	35.00 U	29.60 U	2.00 U	2.30	1.00 U	5.00 U	150.00
E. MISSOULA	SWMP-003	MHD 992	06/27/88	35.00 U	29.60 U	2.00 U	2.00 U	1.00 U	5.00 U	168.00
E. MISSOULA	SWPC-002	MHD 991	06/27/88	105.00	29.60 U	3.10	147.00	1.00 U	5.00 U	35100.00
TURAH	SWP7-001	MHD 997	06/28/88	82.40	29.60 U	5.50	93.60	1.00 U	5.00 U	40400.00
ROMNER	SWP7-002	MHD 999	06/28/88	35.00 U	29.60 U	3.10	147.00	1.00 U	5.00 U	35300.00
E. MISSOULA	SWP2-003	MHE 339	06/28/88	121.00	29.60 U	7.10	147.00	1.00 U	5.00 U	35900.00
E. MISSOULA	SWP2-003-H	MHE 332	06/28/88	35.00 U	29.60 U	2.00 U	2.00 U	1.00 U	5.00 U	54.00 U
E. MISSOULA	SWP2-002-H	MHE 331	06/28/88	35.00 U	29.60 U	2.00 U	2.00 U	1.00 U	5.00 U	83.30
TURAH	SWDS-001	MHE 334	06/29/88	106.00	29.60 U	6.70	92.30	1.00 U	5.00 U	42000.00
ROMNER	SWP2-002	MHE 334	06/29/88	35.00 U	29.60 U	2.00 U	201.00	1.00 U	5.00 U	31600.00
E. MISSOULA	SWP3-001	MHE 331	06/29/88	96.70	29.60 U	3.00 #	143.00	1.00 U	5.00 U	36100.00
E. MISSOULA	SWP7-003-H	MHE 904	06/29/88	75.00 U	29.60 U	2.30 U	2.00 U	1.00 U	5.00 U	124.00
TURAH	SWP3-001	MHE 905	06/30/88	101.00	29.60 U	6.00 U	90.20	1.00 U	5.00 U	39700.00

TOTAL METALS ---- MILLIONAL

SITE NAME	SAMPLE NO	TR NO	DATE	AL AL CUP/L	BB BB CUP/L	AS AS CUP/L	BA BA CUP/L	BE BE CUP/L	CD CD CUP/L	CA CA CUP/L
BONNER	SAMP4-002	MHS 151	06/30/88	83.00	29.00 U	2.00 U W	200.00	1.00 U	5.00 U	30100.00
	SAMP4-003	MHS 153	06/30/88	170.00	29.00 U	3.00	152.00	1.00 U	5.00 U	34500.00
	SAMP4-003-H	MHS 155	06/30/88	37.70	29.00 U	2.00 U	2.00 L	1.00 U	7.10	170.00
	SAMP5-001	MHS 157	07/01/88	74.30	25.00 U	5.30 W	91.20	1.00 U	5.50	40700.00
	SAMP5-001-K	MHS 159	07/01/88	65.60	29.00 U	5.90 W	91.40	1.00 U	5.00 U	41000.00
BONNER	SAMP5-002	MHS 251	07/01/88	35.00 U	29.00 U	2.00 U	195.00	1.00 U	5.00 U	31200.00
	SAMP5-003	MHS 253	07/01/88	127.00	29.00 U	3.30 W	146.00	1.00 U	5.00 U	36500.00
	SAMP5-003-H	MHS 255	07/01/88	35.00 U	29.00 U	2.00 U	2.00 U	1.00 U	5.00 U	64.00 U
	SAMP6-001	MHS 357	07/02/88	35.70	29.00 U	5.50 W	90.40	1.00 U	5.00 U	42400.00
	SAMP6-002	MHS 259	07/02/88	35.00 U	29.00 U	2.00 U	202.00	1.00 U	5.00 U	31600.00
E. MISSOURI	SAMP6-003	MHS 261	07/02/88	295.00	29.00 U	4.20	132.00	1.00 U	5.70	35400.00
	SAMP6-003-H	MHS 263	07/02/88	36.50	29.00 U	2.30 U	2.00 U	1.00 U	5.00 U	193.00
	SAMP7-001	MHS 265	07/03/88	85.30	29.00 U	7.30 W	95.90	1.00 U	5.00 U	40900.00
	SAMP7-002	MHS 093	07/03/88	98.20	29.00 U	2.30 U W	222.30	1.00 U	5.00 U	32100.00
	SAMP7-003	MHS 095	07/03/88	265.00	29.00 U	4.10	164.00	1.00 U	5.00 U	36100.00
E. MISSOURI	SAMP7-003-H	MHS 097	07/03/88	35.00 U	29.00 U	2.00 U	2.00 U	1.00 U	5.00 U	263.00
	SAMP8-001	MHS 099	07/04/88	43.50	29.00 U	5.10	97.70	1.00 U	5.00 U	41500.00
	SAMP8-002	MHS 337	07/04/88	61.10	29.00 U	2.00 U W	225.00	1.00 U	5.00 U	32200.00
	SAMP8-003	MHS 337	07/04/88	258.00	29.00 U	3.90	160.00	1.00 U	5.00 U	36000.00
	SAMP8-003-H	MHS 339	07/04/88	35.00 U	29.00 U	2.00 U	2.00 U	1.00 U	5.00 U	177.30
BONNER	SAMP9-001	MHS 343	07/05/88	41.80	29.00 U	5.90	95.30	1.00 U	5.00 U	43400.00
	SAMP9-002	MHS 345	07/05/88	35.00 U	29.00 U	2.00 L	20.00	1.00 U	5.00 U	28900.00
	SAMP9-003	MHS 347	07/05/88	246.00	29.00 U	4.40	158.00	1.00 U	5.00 U	35900.00
	SAMP9-003-H	MHS 349	07/05/88	35.00 U W	29.00 U W	2.00 U W	2.40 W	1.00 U W	5.00 U W	269.00 W
	SAMP9-003-H	MHS 351	07/05/88	35.00 U W	29.00 U W	2.30 U W	2.00 U W	1.00 U W	5.00 U W	195.00 W
T. GSH	Z-50-001-A	MHS 807	07/06/88	10300.00 W	0.70 U W / U W	17.40 # W + / L B	243.00 W	0.34 W	1.30 W	30100.00 W
	Z-50-001-B	MHS 808	07/06/88	7945.00	0.57 U W	10.80	114.00	0.13 U	0.53	13700.00
BONNER	Z-50-002-A	MHS 809	07/06/88	10400.00 W	0.71 U W / U W	6.90 # W / L B	473.00 W	0.34 W	0.42 W	45300.00 W
	Z-50-002-B	MHS 810	07/06/88	10500.00	0.16 U W	9.70 W	397.00	0.55	2.10	52700.00
	Z-50-003-A	MHS 811	07/06/88	11400.00 W	0.67 U W / U W	24.20 # W / L B	355.00 W	0.54 W	1.70 W	23300.00 W
E. MISSOURI	Z-50-003-B	MHS 812	07/06/88	4090.00	0.60 U W	5.50	95.00	0.12 U	0.30	2180.00
	SITE LEE	MHS 813	07/06/88	247.00 W	293.30 # W / L B	1030.00 W + / L B	9.50 U W	17.00 W	34.20 W	233000.00 W
BONNER	SAMP10-001	MHS 353	07/06/88	115.60 W	29.00 U W	5.10 W	98.10 W	1.00 U W	5.00 U W	46300.00 W
	SAMP10-002	MHS 355	07/06/88	47.30 W	29.00 U W	2.00 U W	213.00 W	1.00 U W	5.00 U W	31200.00 W
	SAMP10-003	MHS 357	07/06/88	400.00 W	29.00 U W	4.20 W	154.00 W	1.00 U W	5.00 U W	33200.00 W
	SAMP10-003-H	MHS 359	07/06/88	135.00 W	29.00 U W	5.50 W	97.40 W	1.00 U W	5.00 U W	45700.00 W
	SAMP10-003-H	MHS 361	07/06/88	135.00 W	29.00 U W	5.50 W	97.40 W	1.00 U W	5.00 U W	45700.00 W

TOTAL METALS ----- MILLTOWN

SITE NAME	SAMPLE NO	TR NO	DATE	PL PL	SS SV	AS AS	PA PA	BE BE	CD CD	CA CA
FOUNDER	SAMPLE 10-002	MHJ 357	07/06/88	46.30 #	29.00 U#	2.00 U#	213.00 #	1.00 U#	5.00 U#	30900.00 #
E. HISSOULA	SAMPLE 10-003	MHJ 361	07/06/88	517.30 #	25.00 U#	4.10 #	111.00 #	1.00 U#	5.00 U#	37900.00 #
E. HISSOULA	SAMPLE 10-003-N	MHJ 365	07/06/88	35.00 U#	29.00 U#	2.20 U#	2.00 U#	1.00 U#	5.00 U#	246.00 #
TURPIN	SAMPLE 11-001	MHJ 367	07/07/88	250.00 #	29.00 U#	5.30 #	91.60 #	1.00 U#	5.00 U#	45100.00 #
E. HISSOULA	SAMPLE 11-003	MHJ 371	07/07/88	641.00 #	29.00 U#	4.90 #	169.00 #	1.00 U#	5.00 U#	39500.00 #
E. HISSOULA	SAMPLE 11-003-N	MHJ 373	07/07/88	35.00 U#	29.00 U#	2.00 U#	2.00 U#	1.00 U#	5.00 U#	172.00 #
FOUNDER	SAMPLE 11-002	MHJ 369	07/08/88	61.60 #	29.00 U#	2.00 U#	221.00 #	1.00 U#	5.00 U#	31800.00 #
TURPIN	SAMPLE 12-001	MHJ 375	07/08/88	157.00 #	29.00 U#	5.60 #	102.00 #	1.00 U#	5.00 U#	45600.00 #
TURPIN	SAMPLE 12-001-K	MHJ 377	07/08/88	141.00 #	29.00 U#	6.40 #	101.00 #	1.00 U#	5.00 U#	44900.00 #
FOUNDER	SAMPLE 12-002	MHJ 379	07/08/88	74.30 #	29.00 U#	2.00 U#	227.00 #	1.00 U#	5.00 U#	31600.00 #
E. HISSOULA	SAMPLE 12-003	MHJ 381	07/08/88	714.00 #	29.00 U#	5.10 #	176.00 #	1.00 U#	5.00 U#	39400.00 #
E. HISSOULA	SAMPLE 12-003-N	MHJ 383	07/08/88	35.00 U#	29.00 U#	2.00 U#	2.50 #	1.00 U#	5.00 U#	211.00 #
TURPIN	SAMPLE 13-001	MHJ 341	07/09/88	165.00	29.00 U	6.30	165.00	1.00 U	5.00 U	47300.00
TURPIN	SAMPLE 13-001-N	MHJ 385	07/09/88	35.00 U#	29.00 U#	2.00 U#	4.50 #	1.00 U#	5.00 U#	200.00 #
FOUNDER	SAMPLE 13-002	MHJ 387	07/09/88	55.10 #	29.00 U#	2.10 U#	201.00 #	1.00 U#	5.00 U#	31300.00 #
E. HISSOULA	SAMPLE 13-003	MHJ 389	07/09/88	244.00	29.00 U	4.90	172.00	1.00 U	5.00 U	40000.00
E. HISSOULA	SAMPLE 13-003-N	MHJ 391	07/09/88	35.00 U	29.00 U	2.00 U	2.30 U	1.00 U	5.00 U	84.00 U
E. HISSOULA	3-50-003-A	MHJ 814	07/10/88	14200.00 #	0.72 U#N /U#S	32.60 #N*/J#S	343.00 #	0.59 #	2.10 #	30200.00 #
E. HISSOULA	3-50-003-B	MHJ 815	07/10/88	3970.00	0.57 U #	6.00	51.30	0.12 U	0.28	2030.00
E. HISSOULA	3-50-003-M	MHJ 816	07/10/88	83.10 U	3.70 U #	2.10 U	48.70 U	0.80 U	1.70 U	102.00 U
E. HISSOULA	3-50-003-W	MHJ 817	07/10/88	83.10 U	3.70 U #	2.10 U	48.70 U	0.80 U	1.70 U	104.00 U
TURPIN	SAMPLE 14-001	MHJ 393	07/10/88	101.00	29.00 U	4.80	106.00	1.00 U	5.00 U	46900.00
FOUNDER	SAMPLE 14-002	MHJ 395	07/10/88	60.90	29.00 U	2.00 U	124.00	1.00 U	5.00 U	33100.00
E. HISSOULA	SAMPLE 14-003	MHJ 397	07/10/88	1110.00	29.00 U	6.60	190.00	1.00 U	5.00 U	40400.00
E. HISSOULA	SAMPLE 14-003-K	MHJ 399	07/10/88	1080.00	29.00 U	8.00	191.00	1.00 U	5.00 U	40200.00
E. HISSOULA	SAMPLE 14-003-N	MHJ 327	07/10/88	35.00 U	29.00 U	2.00 U	6.20	1.00 U	5.00 U	130.00
TURPIN	4-50-001-A	MHJ 818	07/25/88	11400.00 #	0.75 U#N /U#S	22.60 #N*/J#S	282.00 #	0.69 #	1.80 #	35300.00 #
TURPIN	4-50-001-B	MHJ 819	07/25/88	6090.00	0.61 U #	9.80 #	59.80	0.13 U	0.78	7290.00
FOUNDER	4-50-002-A	MHJ 820	07/25/88	10200.00 #	0.74 U#N /U#S	3.70 #N*/J#S	535.00 #	0.35 #	0.34 U#	25400.00 #
FOUNDER	4-50-002-Y	MHJ 821	07/25/88	6540.00	0.57 U #	2.70	239.00	0.11 U	0.24 U	8370.00
FOUNDER	4-50-002-Y-9	MHJ 822	07/25/88	10500.00 #	0.65 U#N /U#S	1.80 #N*/J#S	495.00 #	0.31 #	0.30 U#	25300.00 #
FOUNDER	4-50-002-Y-8	MHJ 823	07/25/88	6480.00	1.95 #	4.70	285.00	0.14 U	0.30 U	6850.00
E. HISSOULA	4 50-003-A	MHJ 924	07/25/88	10100.00 #	0.66 U#N /U#S	24.70 #N*/J#S	714.00 #	0.51 #	1.70 #	9510.00 #
E. HISSOULA	4-50-003-B	MHJ 925	07/25/88	6010.00	0.56 #	6.10	184.00	0.20	0.33	5770.00
TURPIN	5-50-001-A	MHJ 926	07/27/88	12400.00 #	0.70 U#N /U#S	29.10 #N*/J#S	291.00 #	0.19 #	2.20 #	55700.00 #
TURPIN	5-50-001-B	MHJ 927	07/27/88	8710.00	0.64 U #	13.80	131.00	0.14 U	1.00	20900.00

TOTAL METALS --- MILLION

SITE NAME	SAMPLE NO	TR NO	DATE	AL AL OURL	SE SE OURL	AS AS OURL	EA EA OURL	FE FE OURL	CO CO OURL	CA CA OURL
EDWNER	5-SD-002-A	828	07/27/88	101.00 #	2.71 U#M /LIS	4.40 #MS/LIS	507.00 #	0.32 #	0.33 U#	43900.00 #
EDWNER	5-SD-002-B	829	07/27/88	7420.00	0.59 U M	3.90	270.00	0.17	0.28 U	19700.00
E. NISSOULA	5-SD-003-A	830	07/27/88	12500.00 #	0.57 U#M /LIS	41.50 #MS/LIS	357.00 #	0.14 U#	2.80 #	25600.00 #
E. NISSOULA	5-SD-003-B	831	07/27/88	5540.00	0.74 M	8.70	84.30	0.13 U	0.48	3740.00
STD REF	5-SD-004-A	832	07/27/88	239.00 #	250.70 #MS/LIS	130.00 #MS/LIS	8.00 U#	16.50 #	32.95 #	231000.00 #
TRAV. SUMP	5-SD-004-M	833	07/27/88	103.00	3.70 U M	2.10 U	48.70 U	0.80 U	1.70 U	104.00 U
DECUH	5-SD-004-H	834	07/27/88	101.00	3.70 U M	2.10 U	48.70 U	0.80 U	1.70 U	104.00 U

TOTAL METALS ---- MILLITON

SITE NAME	SAMPLE NO	ITR NO	DATE	CR CR QUAL	CO CO QUAL	CU CU QUAL	FE FE QUAL	PB PB QUAL	MG MG QUAL	MM MM QUAL
CF TURFH	SW05-001	MHD 338	06/26/88	6.00 U	6.00 U	10.30	111.00	6.20	9530.00	23.50
BORNER	SW05-002	MHD 342	06/26/88	6.00 U	6.00 U	6.00 U	96.50	2.00 U W	10000.00	9.10
E. MISSOULA	SW05-003	MHD 344	06/26/88	6.00 U	6.00 U	7.50	177.00	2.00 U	9610.00	35.50
E. MISSOULA	SW05-003-K	MHD 346	06/26/88	6.00 U	6.00 U	6.60	151.00	2.50	9900.00	34.60
HELLGATE	SW05-004	MHD 348	06/26/88	6.00 U	6.00 U	6.00 U	147.00	3.70	9550.00	30.40
U. BORDSE	SW05-005	MHD 350	06/26/88	6.00 U	6.00 U	6.00 U	147.00	10.40 S	9900.00	23.00
REVERE ST.	SW05-006	MHD 975	06/26/88	6.00 U	6.00 U	6.60	141.00	2.00 U	9310.00	26.50
SHUFFIELDS	SW05-007	MHD 977	06/26/88	6.00 U	6.00 U	6.00 U	145.00	5.00	9510.00	25.50
SHUFFIELDS	SW05-007	MHD 978	06/26/88	6.00 U	6.00 U	9.70	56.00 U	8.30	70.00 U	7.00 U
SHUFFIELDS	SW05-008	MHD 979	06/26/88	6.00 U	6.00 U	10.30	56.00 U	11.10	70.00 U	7.00 U
SHUFFIELDS	SW05-008	MHD 980	06/26/88	109.00	6.00 U	6.00 U	910.00	325.00	70.00 U	353.00
SHUFFIELDS	SW05-008	MHD 981	06/26/88	55.60	6.00 U	7.80	131.00	169.00	70.00 U	184.00
TURFH	1-50-001-A	MHD 801	06/27/88	15.60 #	6.40 #	255.00 #	10100.00 #	52.10 #	4750.00 #	647.00 #
TURFH	1-50-001-B	MHD 802	06/27/88	9.50	6.00	131.00	7460.70	30.70	3460.00	343.00
BORNER	1-50-002-A	MHD 803	06/27/88	12.10 #	2.90 #	15.10 #	11501.00 #	10.40 #	7560.00 #	510.00 #
BORNER	1-50-002-B	MHD 804	06/27/88	10.30	2.80	13.90	12700.00	10.90	7300.00	569.00
E. MISSOULA	1-50-003-A	MHD 805	06/27/88	16.00 #	9.30 #	209.10 #	13700.00 #	40.70 #	5740.00 #	627.00 #
E. MISSOULA	1-50-003-B	MHD 806	06/27/88	6.40	3.10	55.50	6360.00	13.90	2210.00	239.00
TURFH	SW05-001	MHD 985	06/27/88	6.00 U	6.00 U	8.80	88.00	6.20 SH	10500.00	20.20
BORNER	SW05-002	MHD 987	06/27/88	6.00 U	6.00 U	6.00 U	57.70	7.40 N	10900.00	13.20
E. MISSOULA	SW05-003	MHD 989	06/27/88	6.00 U	6.00 U	7.80	142.00	3.40 N	10600.00	40.70
TURFH	SW05-001	MHD 983	06/27/88	6.00 U	6.00 U	9.50	81.20	2.50 N	10400.00	19.60
BORNER	SW05-002	MHD 989	06/27/88	6.00 U	6.00 U	31.50	64.30	16.50 N	10700.00	10.80
E. MISSOULA	SW05-003	MHD 993	06/27/88	6.00 U	6.00 U	7.40	56.00 U	4.10 N	70.00 U	7.00 U
E. MISSOULA	SW05-003	MHD 997	06/27/88	6.00 U	6.00 U	7.00	56.00 U	6.00 N	70.00 U	7.00 U
E. MISSOULA	SW05-007	MHD 991	06/27/88	6.00 U	6.00 U	8.50	149.00	3.20 N	10700.00	42.40
TURFH	SW05-001	MHD 997	06/28/88	6.00 U	6.00 U	8.10	118.00	2.00 U N	10600.00	25.30
BORNER	SW05-002	MHD 999	06/28/88	6.00 U	6.00 U	6.00 U	56.00 U	7.20 N	11100.00	27.90
E. MISSOULA	SW05-003	MHD 1000	06/28/88	6.00 U	6.00 U	6.70	169.00	3.60 N	11300.00	43.80
E. MISSOULA	SW05-007	MHD 1002	06/28/88	6.00 U	6.00 U	6.00 U	56.00 U	4.00	70.00 U	7.00 U
TURFH	SW05-001	MHD 1004	06/29/88	6.00 U	6.00 U	6.00 U	107.00	5.90	11500.00	27.60
BORNER	SW05-002	MHD 1006	06/29/88	6.00 U	6.00 U	7.80	64.30	6.50	11600.00	12.40
E. MISSOULA	SW05-003	MHD 1008	06/29/88	6.00 U	6.00 U	16.5	176.00	4.30	11300.00	57.90
E. MISSOULA	SW05-007	MHD 1010	06/29/88	6.00 U	6.00 U	6.00 U	56.00 U	2.40	70.00 U	7.00 U
TURFH	SW05-001	MHD 076	06/30/88	6.00 U	6.00 U	6.00 U	105.00	2.30 W	10300.00	20.00

TOTAL METALS ---- MILLION

SITE NAME	SAMPLE NO	ITS NO	DATE	CR CR EQUAL	CO CO EQUAL	CU CU EQUAL	FE FE EQUAL	FR FR EQUAL	MG MG EQUAL	MM MM EQUAL
BOHNER	SMP4-002	MHS 151	06/30/88	6.00 U	6.00 U	6.00 U	74.50	5.10	10400.00	9.60
E. MISSOULA	SMP4-003	MHS 153	06/30/88	6.00 U	6.00 U	6.00 U	157.00	6.60	10550.00	40.70
E. MISSOULA	SMP4-001-N	MHS 155	06/30/88	6.00 U	6.00 U	6.00 U	56.00 U	4.00	70.00 U	7.00 U
TURAN	SMP5-001	MHS 157	07/01/88	6.00 U	6.00 U	6.00	97.60	3.50	10600.00	17.70
TURAN	SMP5-001-K	MHS 159	07/01/88	6.00 U	6.00 U	6.00 U	97.60	4.40	10600.00	18.00
BOHNER	SMP5-002	MHF 251	07/01/88	6.00 U	6.00 U	6.00 U	56.00 U	8.60	11600.00	10.50
E. MISSOULA	SMP5-003	MHF 253	07/01/88	6.00 U	6.00 U	6.70	149.00	3.80	11800.00	55.00
	SMP5-003-N	MHF 255	07/01/88	6.00 U	6.00 U	6.00 U	56.00 U	17.60	70.00 U	7.00 U
TURAN	SMP5-001	MHF 257	07/02/88	6.00 U	6.00 U	6.00	56.00 U	3.50	11600.00	19.00
	SMP5-002	MHF 259	07/02/88	6.00 U	6.00 U	6.00	118.00	4.50	11900.00	9.60
E. MISSOULA	SMP5-003	MHF 261	07/02/88	6.00 U	6.00 U	10.50	351.00	3.50	10700.00	63.40
E. MISSOULA	SMP5-003-N	MHS 263	07/02/88	6.00 U	6.00 U	6.00 U	56.00 U	4.80	70.00 U	7.00 U
TURAN	SMP7-001	MHF 265	07/03/88	6.00 U	6.00 U	6.00 U	57.70	4.20	10700.00	20.60
BOHNER	SMP7-002	MHS 293	07/03/88	6.00 U	6.00 U	7.20	76.00	2.00	11600.00	11.00
E. MISSOULA	SMP7-003	MHS 295	07/03/88	6.00 U	6.00 U	12.70	375.00	2.80	11300.00	73.40
E. MISSOULA	SMP7-003-N	MHS 297	07/03/88	6.00 U	6.00 U	12.30	56.00 U	3.20	70.00 U	7.00 U
TURAN	SMP8-001	MHS 299	07/04/88	6.00 U	6.00 U	19.60	99.40	2.00	10900.00	16.40
BOHNER	SMP8-002	MHS 337	07/04/88	6.00 U	6.00 U	19.10	70.00	2.00	11600.00	13.00
E. MISSOULA	SMP8-003	MHI 337	07/04/88	6.00 U	6.00 U	24.40	376.00	3.00	11100.00	75.40
E. MISSOULA	SMP8-003-N	MHI 339	07/04/88	6.00 U	6.00 U	11.10	56.00 U	2.00	70.00 U	7.00 U
TURAN	SMP9-001	MHI 343	07/05/88	6.00 U	6.00 U	16.20	96.60	2.80	11400.00	20.80
BOHNER	SMP9-002	MHI 345	07/05/88	6.00 U	6.00 U	11.50	64.40	6.40	10500.00	11.70
E. MISSOULA	SMP9-003	MHI 347	07/05/88	6.00 U	6.00 U	22.70	372.00	8.50	11100.00	69.80
E. MISSOULA	SMP9-003-N	MHI 349	07/05/88	6.00 UH	6.00 UH	10.10	56.00 UH	4.30	70.00 UH	7.00 UH
E. MISSOULA	SMP9-003-N	MHI 351	07/05/88	6.00 UH	6.00 UH	6.70	56.00 UH	2.20	70.00 UH	7.00 UH
TURAN	2-50-001-N	MHI 507	07/05/88	13.10 H	2.40 H	193.00 H	11100.00 H	37.70 H	4190.00 H	504.00 H
TURAN	2-50-001-B	MHI 508	07/06/88	9.20	4.00	979.00	979.00	28.30	3450.00	313.00
BOHNER	2-50-001-B	MHI 509	07/06/88	11.00 H	3.80 H	12100.00 H	12100.00 H	10.30 HS	7220.00 H	688.00 H
BOHNER	2-50-002-B	MHI 510	07/06/88	11.20	5.90	17500.00	17500.00	11.60	7350.00	753.00
E. MISSOULA	2-50-003-N	MHI 511	07/06/88	16.10 H	6.30 H	14010.00 H	14010.00 H	35.70 H	5860.00 H	673.00 H
E. MISSOULA	2-50-003-B	MHI 512	07/06/88	6.20	2.50	6120.00	6120.00	13.70	7010.00	203.00
STE 557	2-50-004-N	MHI 513	07/06/88	55.10 H	121.60 H	12710.00 H	12710.00 H	219.00 H	102900.00 H	119.00 H
TURAN	5-0510-001	MHI 755	07/06/88	6.00 UH	6.00 UH	141.00 H	141.00 H	5.70 HS*/J*	11900.00 H	21.00 H
BOHNER	SMP10-002	MHI 756	07/06/88	6.00 UH	6.00 UH	74.00 H	74.00 H	7.20 H*	11600.00 H	8.50 H
E. MISSOULA	SMP10-003	MHI 763	07/06/88	6.00 UH	6.00 UH	557.00 H	557.00 H	9.50 HS*/J*	11300.00 H	76.30 H
TURAN	SMP10-001	MHI 767	07/06/88	6.00 UH	6.00 UH	125.00 H	125.00 H	13.30 HS*/J*	11900.00 H	28.70 H

TOPIC REFERENCE --- HILLTOPPER

DATE NAME	ORFICLE NO	TYPE NO	DATE	CR CR CODE	CU CR CODE	RE FE CODE	FB FB CODE	HB HB CODE	HB HB CODE
ROPER	SWP10-002	MHJ 357	07/06/80	6.00 UH	15.00 #	92.20 #	7.50 #* /J*	11300.00 #	10.10 #
E. MISSOURIA	SWP11-002	MHJ 361	07/06/82	6.00 UH	25.80 #	572.10 #	5.50 #* /J*	11600.00 #	81.10 #
E. MISSOURIA	SWP10-003-H	MHJ 365	07/06/80	6.00 UH	6.00 #	55.00 #	3.00 #* /J*	70.00 UH	7.00 UH
TURSH	SWP11-001	MHJ 367	07/07/82	6.00 UH	20.00 #	257.00 #	4.50 #S*/J*	11500.00 #	43.40 #
E. MISSOURIA	SWP11-003	MHJ 371	07/07/82	6.00 UH	26.70 #	156.00 #	10.90 #S /J*	12900.00 #	87.30 #
E. MISSOURIA	SWP11-003-H	MHJ 375	07/07/83	6.00 UH	6.00 UH	156.00 UH	2.30 # /J*	70.00 UH	7.00 UH
ROPER	SWP11-002	MHJ 369	07/08/86	6.00 UH	8.00 #	77.70 #	5.80 # /J*	12500.00 #	11.10 #
TURSH	SWP12-003	MHJ 373	07/08/88	6.00 UH	12.60 #	182.00 #	2.70 # /J*	12800.00 #	35.60 #
TURSH	SWP12-003-H	MHJ 377	07/08/88	6.00 UH	10.50 #	171.00 #	2.90 # /J*	12800.00 #	29.40 #
ROPER	SWP12-002	MHJ 379	07/08/86	6.00 UH	8.40 #	77.20 #	2.70 # /J*	12200.00 #	14.60 #
E. MISSOURIA	SWP12-003	MHJ 381	07/08/88	6.00 UH	24.70 #	287.00 #	5.00 # /J*	13000.00 #	100.00 #
E. MISSOURIA	SWP12-003-H	MHJ 383	07/08/88	6.00 UH	6.00 UH	56.00 UH	6.40 # /J*	70.00 UH	7.00 UH
TURSH	SWP12-001	MHJ 341	07/09/80	6.00 U	12.00	154.00	2.00 U	13000.00	28.20
TURSH	SWP12-001-H	MHJ 385	07/09/88	6.00 UH	12.50 #	55.00 UH	5.00 # /J*	70.00 UH	7.00 UH
ROPER	SWP13-002	MHJ 387	07/09/88	6.00 UH	17.70 #	59.20 #	2.00 UHH*/UH*	11100.00 #	16.30 #
E. MISSOURIA	SWP13-003	MHJ 389	07/09/88	6.00 U	26.20	414.00	3.20 W	12300.00	92.40
E. MISSOURIA	SWP13-003-N	MHJ 391	07/09/88	6.00 U	6.00 U	52.00 #	2.00 U	70.00 U	7.00 U
E. MISSOURIA	SWP13-003-H	MHJ 395	07/09/88	6.00 U	42.00 #	1800.00 #	45.60 #	5920.00 #	785.00 #
E. MISSOURIA	SWP13-003-H	MHJ 397	07/10/88	6.00 U	40.30	5710.00	14.30	1840.00	197.00
E. MISSOURIA	SWP13-003-H	MHJ 395	07/10/88	6.00 U	7.90 #	265.00	0.80 U	276.00 U	2.60 U
E. MISSOURIA	SWP13-003-H	MHJ 397	07/10/88	6.00 U	7.90 U	47.10	3.20	276.00 U	2.60 U
TURSH	SWP13-001	MHJ 393	07/10/88	6.00 U	10.50	165.00	2.00 U	13500.00	26.50
ROPER	SWP14-002	MHJ 395	07/10/88	6.00 U	6.30	66.20	2.00 U	13400.00	12.80
E. MISSOURIA	SWP14-003	MHJ 397	07/10/88	6.00 U	57.10	1380.60	5.30 S	13400.00	150.00
E. MISSOURIA	SWP14-003-H	MHJ 399	07/10/88	6.00 U	53.70	1410.00	7.80 S	13500.00	152.00
E. MISSOURIA	SWP14-003-H	MHJ 327	07/10/88	6.00 U	6.70	56.00 U	3.20 W	97.60	7.00 U
TURSH	SWP14-001	MHJ 393	07/10/88	6.00 U	220.00 #	11000.00 #	58.10 #	4400.00 #	598.00 #
TURSH	SWP14-001-H	MHJ 395	07/10/88	6.00 U	8.50	730.00	23.10	2650.00	314.00
ROPER	SWP14-002	MHJ 397	07/10/88	6.00 U	12.00 #	10900.00 #	12.40 #	8030.00 #	190.00 #
ROPER	SWP14-002-H	MHJ 399	07/10/88	6.00 U	15.10	10500.00	5.60	7070.00	143.00
ROPER	SWP14-002-H	MHJ 397	07/10/88	6.00 U	20.10 #	16700.00 #	17.10 #	9000.00 #	226.00 #
E. MISSOURIA	SWP14-002-H	MHJ 399	07/10/88	6.00 U	14.10	10800.00	6.10	6740.00	127.00
E. MISSOURIA	SWP14-002-H	MHJ 397	07/10/88	6.00 U	250.10 #	14500.00 #	40.60 #	5430.00 #	772.00 #
E. MISSOURIA	SWP14-002-H	MHJ 399	07/10/88	6.00 U	14.50	16000.00	17.90	6490.00	123.00
TURSH	SWP14-001	MHJ 393	07/10/88	6.00 U	276.00 #	12100.00 #	55.50 #	4670.00 #	552.00 #
TURSH	SWP14-001-H	MHJ 395	07/10/88	6.00 U	152.00	10300.00	36.40	2630.00	321.00

TOTAL METALS --- NUTRIENT

SITE NAME	SAMPLE NO	CTR NO	DATE	CR CR DUAL	CO CO DUAL	CU CU DUAL	FE FE DUAL	PB PB DUAL	MS MS DUAL	MM MM DUAL
BOHMER	5-SB-002-A	MHO 828	07/27/88	11.90 #	2.50 #	14.20 #	10490.00 #	13.90 #B	7090.00 #	304.00 #
BOHMER	5-SB-002-B	MHO 829	07/27/88	8.90	3.00	13.30	11500.00	6.90	6960.00	197.00
E. MISSOURI	5-SB-003-A	MHO 830	07/27/88	15.30 #	4.70 #	395.10 #	13240.00 #	51.30 #	5420.00 #	671.00 #
E. MISSOURI	5-SB-003-B	MHO 831	07/27/88	7.40	5.30	76.10	7750.00	17.40	2800.00	250.00
STO REF	5-SB-004-A	MHO 832	07/27/88	61.70 #	115.00 #	549.10 #	17980.00 #	216.00 #	97600.00 #	163.00 #
TRAIL, ELCH	5-SB-004-B	MHO 833	07/27/88	2.90 U	14.60 U	3.90 U	37.60	0.90	276.00 U	2.60 U
DELEN	5-SB-004-C	MHO 834	07/27/88	2.90 U	14.60 U	3.90 U	58.20	2.70	276.00 U	2.60 U

TOTAL METALS --- PHILLTOWN

SITE NAME	SAMPLE NO	ITR NO	DATE	MS MS CURL	NI NI CURL	K F CURL	SE SE CURL	AB AB CURL	MB R CURL	TR T CURL
CF TURNH	SWDS-001	MHD 338	06/26/88	0.20 U	3.00 U	1960.00	2.00 U HH	4.00 U	7910.00	2.00 U W
BURNER	SWDE-002	MHD 342	06/26/88	0.20 U	3.00 U	589.00	2.00 U HH	4.00 U	3110.00	2.00 U W
E. MTSOULA	SWDS-003	MHD 344	06/26/88	0.20 U	8.00 U	1310.00	2.00 U HH	4.00 U	5690.00	2.00 U W
E. MTSOULA	SWDS-003-1	MHD 346	06/26/88	0.20 U	8.00 U	1320.00	2.00 U HH	4.00 U	5680.00	2.00 U W
HELLBATE	SWDE-004	MHD 348	06/26/88	1.40	9.00 U	1230.00	2.00 U HH	4.00 U	4690.00	2.00 U W
U. BELLESE	SWDS-005	MHD 350	06/26/88	0.20 U	8.00 U	1250.00	2.00 U HH	4.00 U	5190.00	2.00 U W
RESERVE ST.	SWDS-006	MHD 975	06/26/88	0.20 U	8.00 U	1260.00	2.00 U HH	4.00 U	5510.00	2.00 U W
SHUFFIELDS	SWDS-007	MHD 977	06/26/88	0.20 U	8.00 U	1300.00	2.00 U HH	4.00 U	5790.00	2.00 U W
SHUFFIELDS	SWDS-007	MHD 978	06/26/88	0.20 U	8.00 U	1280.00	2.00 U	4.00 U	2000.00 U	2.00 U
SHUFFIELDS	SWDS-008	MHD 979	06/26/88	0.20 U	8.00 U	175.00 U	2.00 U W	4.00 U	2000.00 U	2.00 U
SHUFFIELDS	SWDS-008	MHD 980	06/26/88	4.50	8.00 U	126.00 U	199.00 SH	151.00	2000.00 U	2.00 U W
SHUFFIELDS	SWDS-008	MHD 981	06/26/88	3.30	8.00 U	125.00 U	88.30 SH	77.00	2000.00 U	2.00 U W
TURNH	1-SD-001-A	MHD 801	06/27/88	0.45 # 7/4	7.70 #	1520.00 #	0.17 UHH	0.63 UH	227.00 #	0.29 UH
TURNH	1-SD-001-B	MHD 802	06/27/88	0.15	6.10	1580.00	0.19 U W	0.54 U	178.00	0.30 U
BURNER	1-SD-002-A	MHD 803	06/27/88	0.09 UH 7/3H	6.50 #	2520.00 #	0.19 UHH	0.52 UH	123.00 #	0.30 UH
BURNER	1-SD-002-B	MHD 804	06/27/88	0.10 U	7.70	2540.00	0.18 U W	0.52 U	112.00	0.29 U
E. MTSOULA	1-SD-003-A	MHD 805	06/27/88	0.25 # 7/4	11.40 #	1860.00 #	0.18 UHH	0.62 UH	178.00 #	0.29 UH
E. MTSOULA	1-SD-003-B	MHD 806	06/27/88	0.09 U	3.50	577.00	0.17 U W	0.48 U	106.00	0.27 U
TURNH	SWDS-001	MHD 985	06/27/88	0.20 U	8.00 U	2690.00	2.00 U W	4.00 U	8440.00	2.00 U W
BURNER	SWDS-002	MHD 987	06/27/88	0.20 U	8.00 U	1190.00	2.00 U W	4.00 U	3130.00	2.00 U W
E. MTSOULA	SWDS-003	MHD 995	06/27/88	0.20 U	8.00 U	1930.00	2.00 U W	4.70	6100.00	2.00 U W
TURNH	SWDP-001	MHD 983	06/27/88	0.20 U	8.00 U	2730.00	2.00 U W	4.00 U	9110.00	2.00 U W
BURNER	SWDP-002	MHD 989	06/27/88	0.20 U	8.00 U	1060.00	2.00 U W	4.00 U	2760.00	2.00 U W
E. MTSOULA	SWDP-003	MHD 997	06/27/88	0.20 U	8.00 U	462.00	2.00 U	5.30	2000.00 U	2.00 U
E. MTSOULA	SWDP-002	MHD 992	06/27/88	0.20 U	5.00 U	440.00	2.00 U	4.20	2000.00 U	2.00 U
E. MTSOULA	SWDP-003	MHD 991	06/27/88	0.20 U	7.00 U	1940.00	2.00 U W	4.40	6120.00	2.00 U W
TURNH	SWDP2-001	MHD 997	06/28/88	0.20 U	8.00 U	2750.00	2.00 U W	4.10	8320.00	2.00 U W
BURNER	SWDP2-002	MHD 999	06/28/88	0.20 U	9.00 U	1570.00	2.00 U W	4.00 U	5630.00	2.00 U
E. MTSOULA	SWDP2-003	MHE 330	06/28/88	0.20 U	8.00 U	1610.00	2.00 U W	4.00 U	6540.00	2.00 U
E. MTSOULA	SWDP2-003-1H	MHE 332	06/28/88	0.20 U	8.00 U	125.00 U	1.10	4.00 U	2000.00 U	2.00 U
E. MTSOULA	SWDP2-003-1H	MHE 331	06/28/88	0.20 U	8.00 U	128.00 U	1.00 U	4.00 U	2000.00 U	2.00 U
TURNH	SWDP2-001	MHE 334	06/28/88	0.20 U	8.00 U	2590.00	1.00 U	4.00 U	9230.00	2.00 U W
BURNER	SWDP2-002	MHE 336	06/28/88	0.20 U	8.00 U	789.00	1.20	4.00 U	3700.00	2.00 U
E. MTSOULA	SWDP2-003	MHE 971	06/27/88	0.20 U	8.00 U	1560.00	1.00 U	4.00 U	5320.00	2.00 U W
E. MTSOULA	SWDP2-003-1H	MHE 974	06/28/88	0.20 U	8.00 U	126.00 U	1.00 U	1.00 U	2000.00 U	2.00 U
TURNH	SWDP4-001	MHE 971	06/27/88	0.20 U	8.00 U	2560.00	2.00 U W	4.00 U	9770.00	2.00 U W

TOTAL METALS ---- MILLTONS

SITE NAME	SAMPLE NO	ITE NO	DATE	H6 RE DUAL	H6 RT DUAL	W E DUAL	SE SE DUAL	H6 AG DUAL	NA N DUAL	TH T DUAL
BORNEP	SWPF4-002	MHE 151	06/30/88	0.20 U	8.00 U	812.00	2.00 U	4.00 U	3800.00	2.00 U
E. H1550ULA	SWPF4-003	MHE 153	06/30/88	0.20 U	8.00 U	1520.00	2.00 U W	0.20 U	6050.00	2.00 U W
E. H1550ULA	SWPF4-003-W	MHE 155	06/30/88	0.20 U	8.00 U	126.00 U	2.00 U W	4.00 U	2000.00 U	2.00 U
TUPAH	SWPF5-001	MHE 157	07/01/88	0.20 U	8.00 U	2230.00	2.00 U W	4.00 U	5910.00	2.00 U W
TUPAH	SWPF5-001-W	MHE 159	07/01/88	0.20 U	8.00 U	2260.00	2.00 U W	4.00 U	8300.00	2.00 U W
BORNEP	SWPF5-002	MHE 251	07/01/88	0.20 U	8.00 U	720.00	1.10 W	4.00 U	2620.00	2.00 U
E. H1550ULA	SWPF5-003	MHE 253	07/01/88	0.20 U	8.00 U	1530.00	1.00 U	4.00 U	5790.00	2.00 U W
SWPF5-003-W	MHE 255	07/01/88	0.20 U	8.00 U	126.00 U	1.00 U	1.00 U	4.00 U	2000.00 U	2.00 U
TUPAH	SWPF5-001	MHE 257	07/02/88	0.20 U	8.00 U	2247.00	1.00 U	4.00 U	9630.00	2.00 U W
SWPF6-002	MHE 259	07/02/88	0.20 U	8.00 U	701.00	1.00 U W	1.00 U W	4.00 U	3020.00	2.00 U
E. H1550ULA	SWPF6-003	MHE 261	07/02/88	0.20 U	8.00 U	1530.00	2.00 U W	4.00 U	5950.00	2.00 U W
E. H1550ULA	SWPF6-003-W	MHE 263	07/02/88	0.20 U	8.00 U	126.00 U	2.00 U	4.00 U	2000.00 U	2.00 U
TUPAH	SWPF7-001	MHE 265	07/03/88	0.20 U	8.00 U	2220.00	2.00 U W	4.00 U	8450.00	2.00 U W
BORNEP	SWPF7-002	MHE 093	07/03/88	0.20 U	8.20	907.00	1.00 U W	4.00 U	3200.00	2.00 U
E. H1550ULA	SWPF7-003	MHE 095	07/03/88	0.20 U	8.00 U	1680.00	1.00 U	4.00 U	5980.00	2.00 U W
E. H1550ULP	SWPF7-003-W	MHE 097	07/03/88	0.20 U	8.00 U	126.00 U	1.00 U	4.00 U	2000.00 U	2.00 U
TUPAH	SWPF8-001	MHE 099	07/04/88	0.20 U	8.00 U	2300.00	1.00 U	4.00 U	8350.00	2.00 U W
BORNEP	SWPF8-002	MHE 337	07/04/88	0.20 U	8.00 U	934.00	1.00 U W	4.00 U	2460.00	2.00 U
E. H1550ULA	SWPF8-003	MHE 337	07/04/88	0.20 U	8.60 U	1480.00	1.00 U	4.00 U	5440.00	2.00 U W
E. H1550ULA	SWPF8-003-W	MHE 339	07/04/88	0.20 U	8.00 U	126.00 U	1.00 U	4.00 U	2000.00 U	2.00 U
TUPAH	SWPF9-001	MHE 343	07/05/88	0.20 U	8.00 U	2220.00	1.00 U	4.00 U	8290.00	2.00 U
BORNEP	SWPF9-002	MHE 345	07/05/88	0.20 U	8.00 U	607.00	1.00 U	4.00 U	2000.00 U	2.00 U W
E. H1550ULA	SWPF9-003	MHE 347	07/05/88	0.20 U	8.00 U	1480.00	1.00 U	4.00 U	5460.00	2.00 U W
E. H1550ULA	SWPF9-003-W	MHE 349	07/05/88	0.20 U W	8.00 U W	126.00 U W	2.00 U W	4.00 U W	2000.00 U W	2.00 U W
E. H1550ULA	SWPF9-003-W	MHE 351	07/05/88	0.20 U W	8.00 U W	126.00 U W	2.00 U W	4.00 U W	2000.00 U W	2.00 U W
TUPAH	2-SD-001-A	MHE 507	07/06/88	0.39 W	7.90 W	1280.00	0.18 U W	0.63 U W	246.00 W	0.29 U W
TUPAH	2-SD-001-B	MHE 508	07/06/88	0.13	5.60	1600.00	0.16 U W	0.55 U	187.00	0.25 U
BORNEP	2-SD-002-A	MHE 809	07/06/88	0.09 U W	9.90 W	2310.00	0.20 U W	0.63 U W	118.00 W	0.32 U W
BORNEP	2-SD-002-B	MHE 810	07/06/88	0.10 U	9.20	2060.00	0.12 U W	0.66 U	128.00	0.29 U
E. H1550ULA	2-SD-003-A	MHE 811	07/06/88	0.42 W	11.10 W	1730.00	0.18 U W	0.61 U W	209.00 W	0.29 U W
E. H1550ULA	2-SD-003-B	MHE 812	07/06/88	0.07 U	3.40	701.00	0.16 U W	0.51 U	107.00	0.26 U
STI BOR	2-SD-004-A	MHE 813	07/06/88	13.50 W	50.70 W	362.00 U W	51.80 W	20.90 W	68.50 W	42.40 W
TUPAH	SWPF10-001	MHE 355	07/06/88	0.20 U W	8.00 U W	2530.00	2.00 U W	4.00 U W	10200.00	2.00 U W
BORNEP	SWPF10-002	MHE 357	07/06/88	0.20 U W	8.00 U W	669.00	2.00 U W	4.00 U W	3840.00	2.00 U W
E. H1550ULA	SWPF10-003	MHE 757	07/06/88	0.20 U W	8.00 U W	178.00	2.00 U W	4.00 U W	5770.00	2.00 U W
TUPAH	SWPF10-001	MHE 353	07/06/88	0.20 U W	8.00 U W	2580.00	2.00 U W	4.00 U W	9370.00	2.00 U W

TOTAL METALS ---- MILLION

SITE NAME	SAMPLE NO	ITER NO	DATE	HS HE GRL	NJ RL GRL	SE SE GRL	AS AS GRL	NA N GRL	TH T GRL
ROUNDER	SWMP10-002	MHJ 357	07/06/88	0.20 U#	8.00 U#	695.00 #	4.00 U#	2710.00 #	2.00 U#W
E. MISSOULA	SWMP10-003	MHJ 361	07/06/88	0.20 U#	8.00 U#	1590.00 #	4.00 U#	5850.00 #	2.30 U#W
E. MISSOULA	SWMP10-003-N	MHJ 365	07/06/88	0.20 U#	8.00 U#	125.00 U#	4.00 U#	2000.00 U#	2.00 U#
TURPIN	SWMP11-001	MHJ 367	07/07/88	0.20 U#	8.00 U#	2820.00 #	4.00 U#	9640.00 #	2.00 U#W
E. MISSOULA	SWMP11-003	MHJ 371	07/07/88	0.20 U#	8.00 U#	2040.00 #	4.00 U#	7290.00 #	2.00 U#W/UTS
E. MISSOULA	SWMP11-003-N	MHJ 373	07/07/88	0.20 U#	8.00 U#	125.00 U#	4.00 U#	2000.00 U#	2.00 U#W/UTS
ROUNDER	SWMP11-002	MHJ 369	07/08/88	0.20 U#	8.00 U#	808.00 #	4.00 U#	3160.00 #	2.00 U#W/UTS
TURPIN	SWMP12-001	MHJ 375	07/08/88	0.20 U#	8.00 U#	2750.00 #	4.00 U#	10000.00 #	2.00 U#W/UTS
TURPIN	SWMP12-001-N	MHJ 377	07/08/88	0.20 U#	8.00 U#	2630.00 #	4.00 U#	9720.00 #	2.00 U#W/UTS
ROUNDER	SWMP12-002	MHJ 379	07/08/88	0.20 U#	8.00 U#	921.00 #	4.00 U#	3070.00 #	2.00 U#W/UTS
E. MISSOULA	SWMP12-003	MHJ 381	07/08/88	0.20 U#	8.30 U#	1360.00 #	4.00 U#	6990.00 #	2.00 U#W/UTS
E. MISSOULA	SWMP12-003-N	MHJ 383	07/08/88	0.20 U#	8.00 U#	125.00 U#	4.00 U#	2000.00 U#	2.00 U#W/UTS
TURPIN	SWMP13-001	MHJ 341	07/09/88	0.20 U	8.00 U	2760.00	4.00 U	10800.00	2.00 U W#
TURPIN	SWMP13-001-N	MHJ 385	07/09/88	0.20 U#	8.00 U#	126.00 U#	4.00 U#	2000.00 U#	2.00 U#W/UTS
ROUNDER	SWMP13-002	MHJ 387	07/09/88	0.20 U#	8.00 U#	801.00 #	4.00 U#	2970.00 #	2.00 U#W/UTS
E. MISSOULA	SWMP13-003	MHJ 389	07/09/88	0.20 U	8.00 U	1800.00	4.00 U	7040.00	2.00 U W#
E. MISSOULA	SWMP13-003-N	MHJ 391	07/09/88	0.20 U	8.00 U	126.00 U	4.00 U	2000.00 U	2.00 U N
E. MISSOULA	3-50-003-A	MHJ 814	07/10/88	0.64 # /JH	12.00 #	2240.00 #	0.64 U#	315.00 #	0.47 #
E. MISSOULA	3-50-003-B	MHJ 815	07/10/88	0.02 U	4.30	795.00	0.50 U	117.00	0.25 U
E. MISSOULA	3-51-003-H	MHJ 816	07/10/88	0.20 U	14.50 U	2120.00 U	3.30 U	165.00 U	1.50 U
E. MISSOULA	3-50-003-H	MHJ 817	07/10/88	0.20 U	10.50 U	2120.00 U	3.30 U	165.00 U	1.60 U
TURPIN	SWMP14-001	MHJ 393	07/10/88	0.20 U	8.00 U	2640.00	4.00 U	10000.00	2.00 U W#
ROUNDER	SWMP14-002	MHJ 395	07/10/88	0.20 U	8.00 U	847.00	4.00 U	3240.00	2.00 U W#
E. MISSOULA	SWMP14-003	MHJ 397	07/10/88	0.20 U	8.00 U	2000.00	4.00 U	7250.00	2.00 U W#
E. MISSOULA	SWMP14-003-K	MHJ 399	07/10/88	0.20 U	8.00 U	2050.00	4.00 U	6710.00	2.00 U W#
E. MISSOULA	SWMP14-003-N	MHJ 327	07/10/88	0.20 U	8.00 U	126.00 U	4.00 U	2000.00 U	2.00 U N
TURPIN	4-50-001-A	MHJ 818	07/25/88	0.09 # /JH	5.20 #	1630.00 #	0.67 U#	203.00 #	0.31 U#
TURPIN	4-50-001-B	MHJ 819	07/25/88	0.10 U	5.50	901.00	0.55 U	120.00	0.26 U
ROUNDER	4-50-002-A	MHJ 820	07/25/88	0.10 U# /JH	9.00 #	2240.00 #	0.66 U#	117.00 #	0.29 U#
ROUNDER	4-50-002-B	MHJ 821	07/25/88	0.09 U	7.10	1000.00	0.47 U	68.90	0.26 U
ROUNDER	4-50-002-K	MHJ 822	07/25/88	0.10 U# /JH	9.90 #	2120.00 #	0.59 U#	120.00 #	0.30 U#
ROUNDER	4-50-002-H	MHJ 823	07/25/88	0.06 U	6.20	1070.00	0.58 U	69.10	0.27 U
E. MISSOULA	4-50-003-A	MHJ 824	07/25/88	0.17 # /JH	12.20 #	1710.00 #	0.62 U#	184.00 #	0.27 #
E. MISSOULA	4-50-003-E	MHJ 825	07/25/88	0.06 U	5.30	8.500	0.61 U	66.70	0.24 U
TURPIN	5-50-001-A	MHJ 826	07/27/88	0.21 # /JH	8.70 #	1580.00 #	0.62 U#	220.00 #	0.31 U#
TURPIN	5-50-001-E	MHJ 827	07/27/88	0.41	8.50	1540.00	0.56 U	128.00	0.28 U

TOTAL METALS ---- MILLION

SITE NAME	SAMPLE NO	ITR NO	DATE	Hg MS DUAL	NI NI DUAL	CU CU DUAL	SE SE DUAL	AG AG DUAL	NA N DUAL	TH T DUAL
BURNER	5-SD-002-A	MHO 828	07/27/88	0.10 U# /100H	8.70 #	2350.00 #	0.19 U#H	0.53 U#	116.00 #	0.30 U#
BURNER	5-SD-012-B	MHO 829	07/27/88	0.09 U	5.30	1500.00	0.16 U #	0.55 U	79.90	0.25 U
E. HISSOLA	5-SD-003-A	MHO 830	07/27/88	0.52 # /1H	9.50 #	2350.00 #	0.17 U#H	0.60 U#	186.00 #	0.40 #
E. HISSOLA	5-SD-003-B	MHO 831	07/27/88	0.20 U	5.40	1050.00	0.17 U #	0.55 U	110.00	0.27 U
STD REF	5-SD-004-A	MHO 832	07/27/88	12.30 # /3H	47.50 #	350.00 U#	46.40 #E	22.10 #	38.00 #	42.60 #
TRAIN. BLANK	5-SD-014-H	MHO 833	07/27/88	0.20 U	14.50 U	2120.00 U	1.00 U	3.30 U	165.00 U	1.60 U
DECON	5-SD-004-H	MHO 834	07/27/88	0.20 U	14.50 U	2120.00 U	1.00 U	3.30 U	165.00 U	1.60 U

TOTAL METALS ---- MILLTOWN

SITE NAME	SAMPLE NO	ITS NO	DATE	VA (UGAL)	2N (UGAL)
CF TURCH	SWP5-001	MHD 338	06/26/88	5.00 U	24.00
BOYNER	SWP5-002	MHD 342	06/26/88	5.00 U	4.00
E. MISSOULA	SWP5-003	MHD 344	06/26/88	5.00 U	11.20
E. MISSOULA	SWP5-003-K	MHD 346	06/26/88	5.00 U	27.70
PELLGATE	SWP5-004	MHD 348	06/26/88	5.00 U	14.10
U. WILLOE	SWP5-005	MHD 350	06/26/88	5.00 U	9.60
GEORGE ST.	SWP5-006	MHD 973	06/26/88	5.00 U	14.50
SWPFFIELDS	SWP5-007	MHD 977	06/26/88	5.00 U	8.60
SWPFFIELDS	SWP5-007	MHD 978	06/26/88	5.00 U	7.30
SWPFFIELDS	SWP5-008	MHD 979	06/26/88	5.00 U	7.50
SWPFFIELDS	SWP5-008	MHD 980	06/26/88	5.00 U	473.00
SWPFFIELDS	SWP5-008	MHD 981	06/26/88	5.00 U	8.50
TURCH	1-SB-001-A	MHD 801	06/27/88	21.50 #	673.00 WE /JE
TURCH	1-SB-001-P	MHD 802	06/27/88	14.50	478.00
BOYNER	1-SB-002-P	MHD 803	06/27/88	15.70 #	44.40 WE /JE
BOYNER	1-SB-002-B	MHD 804	06/27/88	14.20	4.40
E. MISSOULA	1-SB-003-A	MHD 805	06/27/88	28.20 #	695.00 WE /JE
E. MISSOULA	1-SB-003-B	MHD 806	06/27/88	10.20	27.00
TURCH	SWP5-001	MHD 985	06/27/88	5.00 U	21.50
BOYNER	SWP5-002	MHD 987	06/27/88	5.00 U	10.50
E. MISSOULA	SWP5-003	MHD 985	06/27/88	5.00 U	23.00
BOYNER	SWP5-001	MHD 983	06/27/88	5.00 U	21.70
BOYNER	SWP5-002	MHD 989	06/27/88	5.00 U	21.00
E. MISSOULA	SWP5-003	MHD 993	06/27/88	5.00 U	13.20
E. MISSOULA	SWP5-003	MHD 992	06/27/88	5.00 U	15.00
E. MISSOULA	SWP5-003	MHD 991	06/27/88	5.00 U	22.50
TURCH	SWP5-004	MHD 997	06/28/88	5.00 U	17.20
BOYNER	SWP5-002	MHD 999	06/28/88	5.00 U	4.70
E. MISSOULA	SWP5-003	MHD 330	06/28/88	5.00 U	25.40
E. MISSOULA	SWP5-003-P	MHD 332	06/28/88	5.00 U	9.10
E. MISSOULA	SWP5-003-H	MHD 331	06/28/88	5.00 U	3.40
TURCH	SWP5-001	MHD 334	06/29/88	5.00 U	19.40
BOYNER	SWP5-002	MHD 336	06/29/88	5.00 U	18.70
E. MISSOULA	SWP5-003	MHD 331	06/29/88	5.00 U	15.70
E. MISSOULA	SWP5-003-H	MHD 334	06/29/88	5.00 U	7.00
TURCH	SWP5-001	MHD 335	06/30/88	5.00 U	1.70

TOTAL METALS --- MILLION

SITE NAME	SAMPLE NO	ITP NO	DATE	VA V DUPL	TH T DUPL
BOILER	SWP4-002	MHS 151	06/30/88	5.00 U	3.90
E. MISSOULA	SWP4-003	MHS 153	06/30/88	5.00 U	12.10
E. MISSOULA	SWP4-003-H	MHS 155	06/30/88	5.00 U	78.90
TURBIN	SWP5-001	MHS 157	07/01/88	5.00 U	17.10
TURBIN	SWP5-001-H	MHS 159	07/01/88	5.00 U	10.00
BOILER	SWP5-002	MHF 251	07/01/88	5.00 U	5.80
E. MISSOULA	SWP5-003	MHF 253	07/01/88	5.00 U	287.00
	SWP5-003-H	MHF 255	07/01/88	5.00 U	20.30
TURBIN	SWP6-001	MHF 257	07/02/88	5.00 U	13.70
	SWP6-002	MHF 259	07/02/88	5.00 U	336.0
E. MISSOULA	SWP6-003	MHF 261	07/02/88	5.00 U	28.90
E. MISSOULA	SWP6-003-H	MHF 263	07/02/88	5.00 U	5.70
TURBIN	SWP7-001	MHF 265	07/03/88	5.00 U	12.10
BOILER	SWP7-002	MHS 093	07/03/88	5.00 U	13.70
E. MISSOULA	SWP7-003	MHS 095	07/03/88	5.00 U	25.30
E. MISSOULA	SWP7-003-H	MHS 097	07/03/88	5.00 U	6.00
TURBIN	SWP8-001	MHS 099	07/04/88	5.00 U	17.70
BOILER	SWP8-002	MHE 337	07/04/88	5.00 U	18.30
E. MISSOULA	SWP8-003	MHJ 337	07/04/88	5.00 U	37.80
E. MISSOULA	SWP8-003-H	MHJ 339	07/04/88	5.00 U	7.90
TURBIN	SWP9-001	MHJ 343	07/05/88	5.00 U	15.80
BOILER	SWP9-002	MHJ 345	07/05/88	5.00 U	10.50
E. MISSOULA	SWP9-003	MHJ 347	07/05/88	5.00 U	28.30
E. MISSOULA	SWP9-003-H	MHJ 349	07/05/88	5.00 UHH /UJS	11.00 # /JE
E. MISSOULA	SWP9-003-H	MHJ 351	07/05/88	5.00 UHH /UJS	7.90 # /JE
TURBIN	2-SD-001-H	MHD 507	07/06/88	17.50 #	314.00 #E /JE
TURBIN	2-SD-001-B	MHD 508	07/06/88	14.80	765.00
BOILER	2-SD-002-H	MHD 509	07/06/88	15.10 #	43.90 #E /JE
BOILER	2-SD-002-B	MHD 510	07/06/88	15.00	48.10
E. MISSOULA	2-SD-003-H	MHD 511	07/06/88	23.50 #	754.00 #E /JE
E. MISSOULA	2-SD-003-B	MHD 512	07/06/88	9.50	251.00
STD REF	2-SD-004-H	MHD 513	07/06/88	54.20 #	150.00 #E /JE
TURBIN	SWP10-001	MHD 355	07/06/88	5.00 UHH /UJS	28.00 # /JE
BOILER	SWP11-002	MHD 359	07/06/88	5.00 UHH /UJS	6.70 UHH /JB
E. MISSOULA	SWP12-003	MHD 367	07/06/88	5.00 UHH /UJS	47.80 # /JE
TURBIN	SWP12-001	MHD 367	07/06/88	5.00 UHH /UJS	26.10 # /JE

7079 RETAIN -- FULL TOWN

SITE NAME	SAMPLE NO	ITP NO	DATE	VA V BURL	7079 RETAIN
FORNER	SWP10-002	MHJ 357	07/06/88	5.00 U#N /UJS	20.50 # /JE
E. MISSOULA	SWP10-003	MHJ 361	07/06/88	5.00 U#N /UJS	13.50 # /JE
E. MISSOULA	SWP10-003-N	MHJ 365	07/06/88	5.00 U#N /UJS	28.70 # /JE
TURAN	SWP11-001	MHJ 367	07/07/88	5.00 U#N /UJS	22.20 # /JE
E. MISSOULA	SWP11-003	MHJ 371	07/07/88	5.00 U#	74.20 # /JE
E. MISSOULA	SWP11-003-N	MHJ 373	07/07/88	5.00 U#	16.60 # /JE
FORNER	SWP11-002	MHJ 369	07/08/88	5.00 U#	20.30 # /JE
TURAN	SWP12-001	MHJ 375	07/08/88	5.00 U#	22.90 # /JE
TURAN	SWP12-001-K	MHJ 377	07/08/88	5.00 U#	20.30 # /JE
FORNER	SWP12-002	MHJ 379	07/08/88	5.00 U#	17.50 # /JE
E. MISSOULA	SWP12-003	MHJ 381	07/08/88	5.00 U#	65.20 # /JE
E. MISSOULA	SWP12-003-N	MHJ 383	07/08/88	5.00 U#	8.20 # /JE
TURAN	SWP12-001	MHJ 341	07/09/88	5.00 U	25.50 #
TURAN	SWP13-001-N	MHJ 385	07/09/88	5.00 U#	9.90 # /JE
FORNER	SWP13-002	MHJ 387	07/09/88	5.00 U#	11.00 # /JE
E. MISSOULA	SWP13-003	MHJ 389	07/09/88	5.00 U	51.20 #
E. MISSOULA	SWP13-003-N	MHJ 391	07/09/88	5.00 U	14.70 #
E. MISSOULA	3-5D-003-A	MHJ 814	07/10/88	23.20 #	794.00 #E /JE
E. MISSOULA	3-5D-003-B	MHJ 815	07/10/88	8.60	246.00
E. MISSOULA	3-5D-003-M	MHJ 816	07/10/88	13.00 U	25.60
E. MISSOULA	3-5D-003-N	MHJ 817	07/10/88	13.00 U	26.60
TURAN	SWP14-001	MHJ 393	07/10/88	5.00 U	15.50 #
FORNER	SWP14-002	MHJ 395	07/10/88	5.00 U	8.00 #
E. MISSOULA	SWP14-003	MHJ 397	07/10/88	5.00 U	110.00 #
E. MISSOULA	SWP14-003-K	MHJ 399	07/10/88	5.00 U	104.00 #
E. MISSOULA	SWP14-003-N	MHJ 327	07/10/88	5.00 U	22.00 #
TURAN	4-5D-001-A	MHJ 818	07/25/88	20.40 #	577.00 #E /JE
TURAN	4-5D-001-B	MHJ 819	07/25/88	11.60	284.00
FORNER	4-5D-002-A	MHJ 820	07/25/88	22.90 #	44.90 #E /JE
FORNER	4-5D-002-B	MHJ 821	07/25/88	30.20	31.60
FORNER	4-5D-002-A	MHJ 822	07/25/88	20.30 #	43.00 #E /JE
FORNER	4-5D-002-B	MHJ 823	07/25/88	28.60	31.90
E. MISSOULA	4-5D-002-C	MHJ 824	07/25/88	28.50 #	946.00 #E /JE
E. MISSOULA	4-5D-003-A	MHJ 825	07/25/88	21.20	273.00
TURAN	5-5D-001-A	MHJ 826	07/27/88	19.70 #	643.00 #E /JE
TURAN	5-5D-001-B	MHJ 827	07/27/88	16.90	429.00

TOTAL METALS --- MILLION

SITE NAME	SAMPLE NO	ITS NO	DATE	VA V GUM	TH Z GUM
CONNET	5-50-002-A	MNO 828	07/27/88	14.20 #	43.20 #E 1E
CONNET	5-50-002-B	MNO 829	07/27/88	29.40	28.90
E. MISSOURIA	5-50-003-A	MNO 830	07/27/88	20.80 #	946.00 #E 1E
E. MISSOURIA	5-50-003-B	MNO 831	07/27/88	13.40	317.00
STD REF	5-50-004-A	MNO 832	07/27/88	53.19 #	155.00 #E 1E
TRAIL BLVD	5-50-004-B	MNO 833	07/27/88	13.90 U	22.50
TRAIL	5-50-004-C	MNO 834	07/27/88	13.00 U	27.80

TOTAL RECOVERABLE --- HILLTOP

SITE NAME	SAMPLE NO	DATE	AL AL QUA	SS SS QUA	AS AS QUA	SA SA QUA	SE SE QUA	CD CD QUA	CA CA QUA
TURSH	SMS-001	06/26/88	139.00 U	50.00 U	7.00 #	38.50	1.20 U	4.20 U	35900.00
ROMER	SMS-002	06/26/88	139.00 U	50.70	3.90 U #	134.00	1.20 U	4.20 U	27100.00
E. MISSOULA	SMS-003	06/26/88	139.00 U	56.00	3.00 U #	136.00	1.20 U	4.20 U	32100.00
E. MISSOULA	SMS-003-K	06/26/88	139.00 U	50.00 U	3.50 U #	135.00	1.20 U	4.20 U	30300.00
HELLGATE	SMS-004	06/26/88	146.00	50.00 U	3.00 U #	131.30	1.20 U	4.20 U	31600.00
RESERVE ST.	SMS-005	06/26/88	139.00 U	51.00 U	3.00 U #	129.00	1.20 U	4.20 U	29800.00
SHEFFIELD	SMS-007	06/26/88	139.00 U	50.00 U	3.50 U #	127.00	1.20 U	4.20 U	31200.00
SHEFFIELD	SMS-008	06/26/88	180.00	65.00	79.00 #	487.00	1.20 U	216.00 U	25500.00
U. PULSEE	SMS-005	06/26/88	171.00	71.20	4.90 #	173.00	1.20 U	4.20 U	30200.00
TURSH	SMS-001	06/27/88	174.00	50.00 U	3.90 U #	73.00	1.20 U	4.20 U	35800.00
ROMER	SMS-002	06/27/88	210.00	59.00	1.50 U #	175.00	1.20 U	4.20 U	27900.00
E. MISSOULA	SMS-003	06/27/88	195.00	51.00 U	3.90 U #	153.00	1.20 U	4.20 U	30800.00
TURSH	SMS-001	06/27/88	179.00	50.00 U	4.00 #	90.00	1.20 U	4.20 U	43100.00
ROMER	SMS-002	06/27/88	152.00	50.00 U	3.00 U #	172.00	1.20 U	4.20 U	27300.00
E. MISSOULA	SMS-003	06/27/88	159.00 U	50.00 U	3.00 U #	105.00	2.30	4.20 U	30800.00
TURSH	SMS-001	06/28/88	139.00 U	50.00 U	3.50 U #	56.70	1.20 U	4.20 U	37100.00
ROMER	SMS-002	06/28/88	164.00	66.20	1.30 U #	181.00	1.20 U	4.20 U	28000.00
E. MISSOULA	SMS-003	06/28/88	139.00 U	50.00 U	3.90 U #	134.00	1.20 U	4.20 U	34000.00
TURSH	SMS-001	06/28/88	139.00 U	55.90	3.00 U #	87.90	1.20 U	4.20 U	39000.00
ROMER	SMS-002	06/28/88	139.00 U	50.00 U	3.90 U #	157.00	1.20 U	4.20 U	29100.00
E. MISSOULA	SMS-003	06/28/88	250.00	61.00	2.00 U #	190.00	1.20 U	4.20 U	34200.00
E. MISSOULA	SMS-003-K	06/28/88	218.00	50.00 U	3.90 U #	6.90 U	2.10	4.20 U	450.00
TURSH	SMS-001	06/30/88	266.00	56.50	2.00 U #	79.10	1.20 U	4.20 U	36800.00
ROMER	SMS-002	06/30/88	273.00	61.00	3.90 U #	187.00	1.20 U	4.20 U	29800.00
E. MISSOULA	SMS-003	06/30/88	202.00	57.00 U	2.00 U #	170.00	1.20 U	4.20 U	33400.00
E. MISSOULA	SMS-003-K	06/30/88	139.00 U	50.00 U	3.00 U #	5.90 U	1.20 U	4.20 U	553.00
TURSH	SMS-001	07/01/88	139.00 U	50.00 U	3.00 U #	37.70	1.20 U	4.20 U	38400.00
TURSH	SMS-001-K	07/01/88	139.00 U	54.20	1.70 #	80.00	1.20 U	4.20 U	39400.00
ROMER	SMS-002	07/01/88	139.00 U	51.00	3.90 U #	180.00	1.20 U	4.20 U	28000.00
E. MISSOULA	SMS-003	07/01/88	235.00	52.50	3.90 U #	140.00	1.20 U	4.20 U	33900.00
E. MISSOULA	SMS-003-K	07/01/88	139.00 U	52.70	3.90 U #	0.00 U	1.20 U	4.20 U	427.00 U
TURSH	SMS-001	07/02/88	186.00	57.00	4.00	81.70 #	5.30 #	5.00 #H /JS	40200.00
ROMER	SMS-002	07/02/88	278.00	65.00	3.20	171.00 #	1.30 #	3.70 UHH /JUS	29000.00
E. MISSOULA	SMS-003	07/02/88	304.00	59.30	3.00	152.00 #	3.30 #	2.80	34900.00
E. MISSOULA	SMS-003-K	07/02/88	507.00	114.00	3.00	11.00	2.10 #	3.70 UHH /JUS	407.00
TURSH	SMS-001	07/03/88	305.00	58.00	4.00	55.90 #	4.30 #	3.30 UHH /JUS	39100.00

TOTAL RECOVERABLE ---- MILLION

SITE NAME	SAMPLE NO	DATE	AL CUMUL	SB SB CUMUL	AE AS CUMUL	34 FA CUMUL	BE BE CUMUL	CD CD CUMUL	CA CA CUMUL
POWDER	SMP7-002	07/03/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	198.00 #	3.40 #	3.70 UMN /US	32400.00 HE /JE
E. NISSEOLA	SMP7-003	07/03/88	249.00 MN* /JS	58.00 UMN* /RS	3.50 UMN	143.00 #	3.40 #	5.00 MN /JS	36300.00 HE /JE
E. NISSEOLA	SMP7-003-H	07/03/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	11.00 UMN	1.40 #	3.70 UMN /US	403.60 UHE /UJE
TURAH	SMP8-001	07/04/88	163.00 UMN* /US	58.00 UMN* /RS	5.50 UMN* /JS	79.30 #	1.50 #	3.70 UMN /US	42100.00 HE /JE
POWDER	SMP8-002	07/04/88	163.00 UMN* /US	60.10 MN* /JS	3.50 UMN	189.00 #	0.80 UMN	3.70 UMN /US	30300.00 HE /JE
E. NISSEOLA	SMP8-003	07/04/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	149.00 #	2.30 #	3.70 UMN /US	37200.00 HE /JE
E. NISSEOLA	SMP8-003-H	07/04/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	11.00 UMN	0.80 UMN	3.70 UMN /US	403.00 HE /UJE
TURAH	SMP9-001	07/05/88	163.00 UMN* /US	58.00 UMN* /RS	8.10 MN* /JS	93.20 #	1.70 #	3.70 UMN* /US	46400.00 HE /JE
POWDER	SMP9-002	07/05/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	212.00 #	2.60 #	3.70 UMN /US	32600.00 HE /JE
E. NISSEOLA	SMP9-002	07/05/88	190.00 MN* /JS	58.00 UMN* /RS	4.40 MN* /JS	153.00 #	3.50 #	3.70 UMN* /US	39400.00 HE /JE
E. NISSEOLA	SMP9-003-H	07/05/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	11.00 UMN	2.80 #	3.70 UMN /US	403.00 UHE /UJE
E. NISSEOLA	SMP9-003-H	07/05/88	169.00 U	58.00 U	3.50 U	11.00 U	0.80 U	3.70 U	511.00
TURAH	SMS10-001	07/06/88	163.00 UMN* /US	58.00 UMN* /RS	8.80 MN* /JS	88.40 #	3.10 #	4.40 MN /JS	47300.00 HE /JE
POWDER	SMS10-002	07/06/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	212.00 #	0.80 UMN	3.70 UMN /US	33000.00 HE /JE
E. NISSEOLA	SMS10-003	07/06/88	163.00 UMN* /US	58.00 UMN* /RS	5.00 UMN* /JS	159.00 #	0.80 UMN	3.70 UMN /US	41200.00 HE /JE
TURAH	SMP11-001	07/07/88	163.00 UMN* /US	58.00 UMN* /RS	4.50 MN* /JS	49.50 #	2.30 #	3.70 UMN /US	27300.00 HE /JE
POWDER	SMP10-002	07/06/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	11.00 UMN	0.80 UMN	3.70 UMN /US	493.00 UHE /UJE
E. NISSEOLA	SMP10-003	07/06/88	241.00 MN* /JS	58.00 UMN* /RS	3.50 UMN	165.00 #	1.30 #	3.70 UMN /US	41900.00 HE /JE
E. NISSEOLA	SMP10-003-H	07/06/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	11.00 UMN	0.80 UMN	3.70 UMN /US	403.00 UHE /UJE
TURAH	SMP11-001	07/07/88	589.00 MN* /JS	110.00 MN* /JS	9.10 MN* /JS	52.40 #	2.70 #	3.70 UMN /US	41400.00 HE /JE
POWDER	SMP11-002	07/07/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	212.00 #	0.80 UMN	3.70 UMN /US	32300.00 HE /JE
E. NISSEOLA	SMP11-003	07/07/88	336.00 MN* /JS	58.00 UMN* /RS	5.70 MN* /JS	139.00 #	1.50 UMN	3.70 UMN /US	47500.00 HE /JE
E. NISSEOLA	SMP11-003-H	07/07/88	163.00 UMN* /US	58.00 UMN* /RS	3.50 UMN	11.00 UMN	0.80 UMN	3.70 UMN /US	403.00 UHE /JE
TURAH	SMP12-001	07/08/88	169.00 U	58.00 U	8.10	141.00	0.80	3.70 U	44600.00
TURAH	SMP12-001-H	07/08/88	169.00 U	58.00 U	8.10	38.00	0.80 U	3.70 U	42400.00
POWDER	SMP12-002	07/08/88	169.00 U	58.00 U	3.50 U	214.00	0.30 U	3.70 U	31000.00
E. NISSEOLA	SMP12-003	07/08/88	463.00	58.00 U	6.00	163.00	0.50 U	3.70 U	38400.00
E. NISSEOLA	SMP12-003-H	07/08/88	169.00 U	58.00 U	3.50 U	11.00 U	1.50 U	3.70 U	493.00 U
TURAH	SMP12-001	07/09/88	169.00 U	58.00 U	8.70	109.00	0.80 U	3.70 U	43800.00
TURAH	SMP13-001-H	07/09/88	169.00 U	58.00 U	3.50 U	11.00 U	0.30 U	3.70 U	493.00 U
POWDER	SMP13-002	07/09/88	169.00 U	58.00 U	3.50 U #	214.00	0.30 U	3.70 U	31600.00
E. NISSEOLA	SMP13-003	07/09/88	299.00	58.00 U	7.80	164.00	0.30 U	3.70 U	37900.00
E. NISSEOLA	SMP13-003-H	07/09/88	169.00 U	58.00 U	3.50 U	11.00 U	0.30 U	3.70 U	493.00 U
TURAH	SMS10-001	07/10/88	169.00 U	58.00 U	3.50 U	76.10	0.30 U	3.70 U	79000.00
TURAH	SMP14-001	07/10/88	169.00 U	58.00 U	3.50 U	215.00	0.30 U	3.70 U	3700.00
POWDER	SMP14-002	07/10/88	169.00	58.00 U	8.10	181.10	0.20 U	3.50	38200.00

TOTAL RECOVERABLE --- MILLION

SITE NAME	SAMPLE NO	DATE	AL AL CUBAL	S2 S2 CUBAL	AE AE CUBAL	BE BE CUBAL	CE CE CUBAL	EA EA CUBAL
E. MISSOULA	CAMP14-003	07/10/88	902.00	58.00 U	5.30	0.20 U	5.10	35500.00
E. MISSOULA	CAMP14-003-H	07/10/88	169.00 U	52.00 U	7.50 U	7.80 U	3.70 U	403.00 U

TOTAL RECOVERABLE --- MILLION

WELL NAME	SAMPLE NO	DATE	CR CR CURL	CD CD CURL	20 CU CURL	FE FE CURL	FE FE CURL	MS MS CURL	MS MS CURL
TURBID	SMP05-001	06/26/88	9.80 U	9.70 U	17.00 U	151.00	0.50 U M	8530.00	15.70
ROUNDER	SMP05-002	06/26/88	9.80 U	11.60	17.00 U	73.00 U	1.10 M	9400.00	9.30 U
E. MISSOULA	SMP05-003	06/26/88	9.80 U	8.70 U	17.00 U	38.00 U	2.60 M	8760.00	25.80
E. MISSOULA	SMP05-003-R	06/26/88	9.80 U	8.70 U	17.00 U	164.00	0.70 U M	8680.00	35.70
PELLICATE	SMP05-004	06/26/88	9.80 U	8.70 U	17.00 U	182.00	0.90 U M	8670.00	77.60
RESERVE ST.	SMP05-005	06/26/88	9.80 U	8.70 U	17.00 U	124.00	0.70 U M	8440.00	25.60
SHUFFIELDS	SMP05-007	06/26/88	9.80 U	9.70 U	17.00 U	255.00	0.50 U M	8810.00	70.40
SHUFFIELDS	SMP05-008	06/26/88	107.00	9.70 U	17.00 U	253.00	325.00 M	700.00 U	337.90
U. DIFUSE	SMP05-005	06/26/88	9.80 U	8.70 U	17.00 U	131.00	1.10 M	8350.00	22.20
TURBID	SMP05-001	06/27/88	9.80 U	8.70 U	17.00 U	112.00	0.90 U M	8730.00	9.30 U
ROUNDER	SMP05-002	06/27/88	9.80 U	8.70 U	17.00 U	114.00	2.40 M	8850.00	9.30 U
E. MISSOULA	SMP05-003	06/27/88	9.80 U	8.70 U	17.00 U	137.00	0.50 U M	8590.00	29.70
TURBID	SMP05-001	06/27/88	9.80 U	9.70 U	17.00 U	194.00	1.30 M	10400.00	13.50
ROUNDER	SMP05-002	06/27/88	9.80 U	8.70 U	17.00 U	275.00	21.60 M	5890.00	11.30
E. MISSOULA	SMP05-003	06/27/88	9.80 U	8.70 U	17.00 U	184.00	1.20 M	8430.00	32.00
TURBID	SMP05-001	06/28/88	9.80 U	8.70 U	17.00 U	149.00	0.75 U	8730.00	15.20
ROUNDER	SMP05-002	06/28/88	9.80 U	8.70 U	128.00	89.00	1.50 M	9260.00	9.30 U
E. MISSOULA	SMP05-003	06/28/88	9.80 U	8.70 U	17.00 U	180.00	1.10 M	9370.00	33.40
TURBID	SMP05-001	06/29/88	9.80 U	8.70 U	17.00 U	169.00	1.40 M	9250.00	23.10
ROUNDER	SMP05-002	06/29/88	9.80 U	8.70 U	17.00 U	126.00	0.50 U M	9330.00	12.30
E. MISSOULA	SMP05-003	06/29/88	9.80 U	8.70 U	17.00 U	277.00	0.90 U M	9110.00	49.50
E. MISSOULA	SMP05-003-R	06/29/88	9.80 U	8.70 U	17.00 U	59.10	0.90 U M	700.00 U	9.30 U
TURBID	SMP05-001	06/30/88	9.80 U	8.70 U	17.00 U	110.00	0.90 U M	8980.00	9.30 U
ROUNDER	SMP05-002	06/30/88	9.80 U	8.70 U	17.00 U	107.00	1.30 M	9370.00	9.30 U
E. MISSOULA	SMP05-003	06/30/88	9.80 U	8.70 U	17.00 U	192.00	2.20 M	1180.00	9380.00
TURBID	SMP05-001	07/01/88	9.80 U	8.70 U	17.00 U	57.00	0.50 U M	700.00 U	9.30 U
TURBID	SMP05-001-R	07/01/88	9.80 U	8.70 U	17.00 U	116.00	0.55 M	9280.00	9.50
ROUNDER	SMP05-002	07/01/88	9.80 U	8.70 U	17.00 U	107.00	2.40 M	9320.00	15.00
E. MISSOULA	SMP05-003	07/01/88	9.80 U	9.10	17.00 U	81.00	1.10 M	9250.00	9.30 U
E. MISSOULA	SMP05-003-R	07/01/88	9.80 U	8.70 U	17.00 U	207.00	3.20 M	9230.00	44.10
TURBID	SMP05-001	07/02/88	6.50 U	8.70 U	17.00 U	94.00	2.00 M	700.00 U	9.30 U
ROUNDER	SMP05-002	07/02/88	6.50 U	8.70 U	22.00 U	80.50	1.70 M	9750.00	16.40
E. MISSOULA	SMP05-003	07/02/88	6.50 U	8.70 U	22.00 U	111.00	1.10 M	9080.00	6.10 U
E. MISSOULA	SMP05-003-R	07/02/88	6.50 U	8.70 U	22.00 U	261.00	2.80 M	9330.00	53.30
E. MISSOULA	SMP05-003-R	07/02/88	6.50 U	8.70 U	22.00 U	70.00	3.70 U	495.00 U	9.60
TURBID	SMP05-001	07/03/88	6.50 U	8.70 U	22.00 U	71.60	0.50 U	9130.00	17.40

TOTAL RECOVERABLE --- MILLTOWN

SITE NAME	SAMPLE NO	DATE	CR CR DUAL	CU CU DUAL	FE FE DUAL	MG MG DUAL	MM MM DUAL
BONNER	SMP7-002	07/03/88	6.90 UH	22.00 UH	38.50 #	0.95 #MM/JIS	9830.00 #
E. MISSOULA	SMP7-002	07/03/88	6.90 UH	24.10 #	539.00 #	1.90 #MM/JIS	9810.00 #
E. MISSOULA	SMP7-003-H	07/03/88	6.90 UH	22.00 UH	30.00 UH	2.70 #H/JIS	495.00 UH
TURAH	SMP8-001	07/04/88	6.90 UH	22.00 UH	90.70 #	1.10 #MM/JIS	9770.30 #
BONNER	SMP8-002	07/04/88	6.90 UH	22.00 UH	101.00 #	1.20 #MM/JIS	9650.00 #
E. MISSOULA	SMP8-003	07/04/88	6.90 UH	22.00 UH	34.50 #	0.95 #MM/JIS	10300.00 #
E. MISSOULA	SMP8-003-H	07/04/88	6.90 UH	22.00 UH	194.00 #	1.00 #H/JIS	495.00 UH
TURAH	SMP9-001	07/05/88	6.90 UH	22.00 UH	227.00 #	0.95 #MM/JIS	10400.00 #
BONNER	SMP9-002	07/05/88	6.90 UH	22.00 UH	67.30 #	1.00 #MM/JIS	10500.00 #
E. MISSOULA	SMP9-003	07/05/88	6.90 UH	22.00 UH	402.00 #	2.50 #MM/JIS	10600.00 #
E. MISSOULA	SMP9-003-H	07/05/88	6.90 UH	22.00 UH	76.60 #	0.90 UH#H	495.00 UH
E. MISSOULA	SMP9-003-H	07/05/88	6.90 U	22.00 U	75.50	3.40 S	495.00 U
TURAH	SMS10-001	07/06/88	6.90 UH	22.00 UH	296.00 #	1.50 #MM/JIS	10900.00 #
BONNER	SMS10-002	07/06/88	6.90 UH	22.00 UH	57.50 #	1.10 #H/JIS	11000.00 #
E. MISSOULA	SMS10-003	07/06/88	6.90 UH	26.20 #	531.30 #	3.50 #MM/JIS	11200.00 #
TURAH	SMP10-001	07/06/88	6.90 UH	22.00 UH	119.00 #	1.50 #MM/JIS	6140.00 #
BONNER	SMP10-002	07/06/88	6.90 UH	22.00 UH	30.00 UH	1.00 #MM/JIS	495.00 UH
E. MISSOULA	SMP10-003	07/06/88	6.90 UH	25.20 #	504.00 #	2.70 #MM/JIS	11500.00 #
E. MISSOULA	SMP10-003-H	07/06/88	6.90 UH	22.00 UH	70.30 UH	0.90 UH#H	495.00 UH
TURAH	SMP11-001	07/07/88	6.90 UH	22.00 UH	192.00 #	1.90 #MM/JIS	9010.00 #
BONNER	SMP11-002	07/07/88	6.90 UH	22.00 UH	30.00 UH	1.30 #MM/JIS	10900.00 #
E. MISSOULA	SMP11-003	07/07/88	6.90 UH	36.90 #	558.00 #	3.10 #MM/JIS	13000.00 #
E. MISSOULA	SMP11-003-H	07/07/88	6.90 UH	22.00 UH	30.30 UH	0.90 UH#H	495.00 UH
TURAH	SMP12-001	07/08/88	6.90 U	22.00 U	238.00	1.30	10700.00
TURAH	SMP12-001-H	07/08/88	6.90 U	22.00 U	109.90	1.60 H	10100.00
BONNER	SMP12-002	07/08/88	6.90 U	22.00 U	99.70	0.90 U	10300.00
E. MISSOULA	SMP12-003	07/08/88	9.70	31.20	779.00	4.40 S	10700.00
E. MISSOULA	SMP12-003-H	07/08/88	6.90 U	22.00 U	37.30	0.90 U	495.00 U
TURAH	SMP13-001	07/09/88	6.90 U	22.00 U	150.10	0.95	10700.00
TURAH	SMP13-001-H	07/09/88	6.90 U	22.00 U	35.30	0.90 U	495.00 U
BONNER	SMP13-002	07/09/88	6.90 U	22.00 U	91.20	0.90 U	10500.00
E. MISSOULA	SMP13-003	07/09/88	6.90 U	37.30	668.00	3.30	10500.00
E. MISSOULA	SMP13-003-H	07/09/88	6.90 U	22.00 U	96.10	0.90 U	495.00 U
TURAH	SMP14-001	07/10/88	6.90 U	22.00 U	192.30	0.90 U H	9020.00
TURAH	SMP14-001-H	07/10/88	6.90 U	22.00 U	337.00	0.90 U	10500.00
BONNER	SMP14-002	07/10/88	6.90 U	37.30	1200.00	7.30 S	10900.00

05/09/89

TOTAL RECOVERABLE ---- MILLION

SITE NAME	SAMPLE NO	DATE	CR CR GUAL	CO CO GUAL	CU CU GUAL	FE FE GUAL	P2 P2 GUAL	MG MG GUAL	MM MM GUAL
E. MISSOULA	SMP14-003	07/10/85	6.90 U	7.20 U	54.00	1350.00	7.10 S	11000.00	150.00
E. MISSOULA	SMP14-003-M	07/10/85	6.90 U	7.90	37.00	47.70	0.90 U	495.00 U	19.80

TOTAL RECONSTRUCTABLE ---- WILL TOWN

SITE NAME	SAMPLE NO	DATE	AS HS GUAL	KI MI GUAL	K K GUAL	SE SE GUAL	AG AS GUAL	MA N GUAL	TH T GUAL
TUPAH	SWDS-001	06/26/88	0.20 U N	22.00 U	1150.00	0.00	9.60 U N	7660.00	2.30 U N
BONNER	SWDS-002	06/26/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWDS-003	06/26/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWDS-003-K	06/26/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
HELLGATE	SWDS-004	06/26/88	0.20 U N	22.00 U	1390.00	3.10 U N	9.60 U N	3700.00 U	2.30 U N
RESERVE ST.	SWDS-006	06/26/88	0.20 U N	22.00 U	1390.00	3.10 U N	9.60 U N	6070.00	2.30 U N
SHERFIELD	SWDS-007	06/26/88	0.20 U N	22.00 U	1600.00	3.10 U N	9.60 U N	4440.00	2.30 U N
SHERFIELD	SWDS-008	06/26/88	2.10 N	22.00 U	873.00 U	133.00 N	157.00 N	3700.00 U	2.30 U N
U. RABBIT	SWDS-005	06/26/88	0.20 U N	22.00 U	1600.00	3.10 U N	9.60 U N	5260.00	2.30 U N
TUPAH	SWDS-001	06/27/88	0.20 U N	22.00 U	1390.00	3.20	9.60 U N	4680.00 U N	2.30 U N
BONNER	SWDS-002	06/27/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWDS-003	06/27/88	0.20 U N	22.00 U	873.00 U	3.60 N	9.60 U N	5730.00	2.30 U N
TUPAH	SWPF-001	06/27/88	0.20 U N	22.00 U	2020.00	3.10 U N	9.60 U N	7270.00	2.30 U N
BONNER	SWPF-002	06/27/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWPF-003	06/27/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	4840.00	2.30 U N
TUPAH	SWPF2-001	06/28/88	0.20 U N	22.00 U	1500.00	3.30 U N	9.60 U N	7020.00	2.30 U N
BONNER	SWPF2-002	06/28/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWPF3-001	06/28/88	0.20 U N	22.00 U	970.00	3.10 U N	9.60 U N	3700.00 U	2.30 U N
TUPAH	SWPF3-002	06/28/88	0.20 U N	22.00 U	2270.00	3.10 U N	9.60 U N	8440.00	2.30 U N
BONNER	SWPF3-003	06/29/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWPF3-003-N	06/29/88	0.20 U N	22.00 U	1180.00	3.10 U N	9.60 U N	4040.00	2.30 U N
TUPAH	SWPF4-001	06/30/88	0.20 U N	22.00 U	1600.00	3.60 N	9.60 U N	5200.00	2.30 U N
BONNER	SWPF4-002	06/30/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWPF4-003	06/30/88	0.00	3800.00	873.00 U	34.50 N	9.60 U N	3700.00 U	2.50 N
E. MISSOULA	SWPF4-003-N	06/30/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
TUPAH	SWPF5-001	07/01/88	0.20 U N	22.00 U	1390.00	3.10 U N	9.60 U N	5090.00	2.30 U N
BONNER	SWPF5-002	07/01/88	0.20 U N	22.00 U	1600.00	3.10 U N	9.60 U N	9210.00	2.30 U N
E. MISSOULA	SWPF5-003	07/01/88	0.20 U N	22.00 U	873.00 U	3.10 U N	9.60 U N	3700.00 U	2.30 U N
E. MISSOULA	SWPF5-003-N	07/01/88	0.20 U N	22.00 U	970.00	3.10 U N	9.60 U N	5090.00	2.30 U N
TUPAH	SWPF6-001	07/02/88	0.25 N	15.00 UH	901.00 N	3.10 UH	8.20 UH	15500.00 N* /J*	2.30 UH
BONNER	SWPF6-002	07/02/88	0.25 N	16.00 UH	2500.00 N	3.10 UH	8.20 UH	10900.00 N* /J*	2.30 UH
E. MISSOULA	SWPF6-003	07/02/88	0.20 UH	16.00 UH	3510.00 N	3.10 UH	8.20 UH	19900.00 N* /J*	2.30 UH
E. MISSOULA	SWPF6-003-N	07/02/88	0.20 UH	16.00 UH	2100.00 N	3.10 UH	8.20 UH	22200.00 N* /J*	2.30 UH
TUPAH	SWPF7-001	07/03/88	0.20 N	15.00 UH	3600.00 N	3.10 UH	8.20 UH	34700.00 N* /J*	2.30 UH

TOTAL RECOVERABLE ---- MILLION

STATE NAME	SAMPLE NO	DATE	HG HG DUAL	WT WT DUAL	1 K DUAL	SE SE DUAL	AE AE DUAL	NA N DUAL	TH T DUAL
BONNER	SMP7-002	07/03/88	0.20 U#	15.00 U#	2530.00 #	3.10 U#	8.20 U#N /RS	2870.00 U#* /U#*	2.30 U#
E. MISSOURI	SMP7-002	07/03/88	0.20 U#	15.00 U#	3170.00 #	3.10 U#	8.20 U#N /RS	5350.00 #* /J*	2.30 U#
E. MISSOURI	SMP7-003-N	07/03/88	0.20 U#	15.00 U#	1990.00 #	3.10 U#	8.20 U#N /RS	4310.00 #* /J*	2.30 U#
TURAH	SMP8-001	07/04/88	0.20 U#	15.00 U#	3940.00 #	3.10 U#	8.20 U#N /RS	11900.00 #* /J*	2.30 U#
BONNER	SMP8-002	07/04/88	0.20 U#	15.00 U#	2830.00 #	3.10 U#	8.20 U#N /RS	5920.00 #* /J*	2.30 U#
E. MISSOURI	SMP8-003	07/04/88	0.20 U#	15.00 U#	3170.00 #	3.10 U#	8.20 U#N /RS	9050.00 #* /J*	2.30 U#
E. MISSOURI	SMP8-003-N	07/04/88	0.20 U#	15.00 U#	1830.00 #	3.10 U#	8.20 U#N /RS	2870.00 #* /U#*	2.30 U#
TURAH	SMP9-001	07/05/88	0.20 U#	15.00 U#	3680.00 #	3.10 U#	8.20 U#N /RS	10400.00 #* /J*	2.30 U#
BONNER	SMP9-002	07/05/88	0.20 U#	15.00 U#	2160.00 #	3.10 U#	8.20 U#N /RS	5140.00 #* /J*	2.30 U#
E. MISSOURI	SMP9-003	07/05/88	0.36 #	15.00 U#	3340.00 #	3.10 U#	8.20 U#N /RS	5740.00 #* /J*	2.30 U#
E. MISSOURI	SMP9-003-N	07/05/88	0.48 #	15.00 U#	2160.00 #	3.10 U#	8.20 U#N /RS	2870.00 U#* /U#*	2.30 U#
E. MISSOURI	SMP9-003-N	07/05/88	0.00	32.70	1570.00	3.10 U#	8.20 U#	2870.00 U	2.30 U
TURAH	SMP10-001	07/06/88	0.55 #	16.00 U#	3840.00 #	3.10 U#	8.20 U#N /RS	8490.00 #* /J*	2.30 U#
BONNER	SMP10-002	07/06/88	0.20 U#	15.00 U#	2870.00 #	3.10 U#	8.20 U#N /RS	4460.00 #* /J*	2.30 U#
E. MISSOURI	SMP10-003	07/06/88	0.48 #	15.00 U#	3520.00 #	3.10 U#	8.20 U#N /RS	6750.00 #* /J*	2.30 U#
TURAH	SMP10-001	07/06/88	0.44 #	15.00 U#	3170.00 #	3.10 U#	8.20 U#N /RS	4230.00 #* /J*	2.30 U#
BONNER	SMP10-002	07/06/88	0.48 #	15.00 U#	2500.00 #	3.10 U#	8.20 U#N /RS	2870.00 U#* /U#*	2.30 U#
E. MISSOURI	SMP10-003	07/06/88	0.44 #	15.00 U#	3000.00 #	3.10 U#	8.20 U#N /RS	5830.00 #* /J*	2.30 U#
E. MISSOURI	SMP10-003-N	07/06/88	0.51 #	15.00 U#	2500.00 #	3.10 U#	8.20 U#N /RS	2870.00 U#* /U#*	2.30 U#
TURAH	SMP11-001	07/07/88	0.36 #	17.50 #	4150.00 #	3.10 U#	8.20 U#N /RS	4960.00 #* /J*	2.30 U#
BONNER	SMP11-002	07/07/88	0.40 #	15.00 U#	2670.00 #	3.10 U#	8.20 U#N /RS	2870.00 U#* /U#*	2.30 U#
E. MISSOURI	SMP11-003	07/07/88	0.40 #	15.00 U#	3650.00 #	3.10 U#	8.20 U#N /RS	9130.00 #* /J*	2.30 U#
E. MISSOURI	SMP11-003-N	07/07/88	0.33 #	16.00 U#	1990.00 #	3.10 U#	8.20 U#N /RS	2870.00 U#* /U#*	2.30 U#
TURAH	SMP12-001	07/08/88	0.20 U	15.90	3410.00	3.10 U	8.20 U	10300.00	2.30 U
TURAH	SMP12-001-N	07/08/88	0.20 U	17.30	1910.00	3.10 U#	8.20 U	9190.00	2.30 U
BONNER	SMP12-002	07/08/88	0.20 U	16.10	420.00	3.10 U#	8.20 U	3460.00	2.30 U
E. MISSOURI	SMP12-003	07/08/88	0.20 U	15.00 U	1110.00	3.10 U#	8.20 U	2870.00 U	2.30 U
E. MISSOURI	SMP12-003-N	07/08/88	0.20 U	30.30	348.00 U	3.10 U#	8.20 U	2870.00 U	2.30 U
TURAH	SMP13-001	07/09/88	0.20 U	22.00	3150.00	3.10 U#	8.20 U	9640.00	2.30 U
TURAH	SMP13-001-N	07/09/88	0.20 U	15.00 U	1110.00	3.30	8.20 U	2870.00 U	2.30 U
BONNER	SMP13-002	07/09/88	0.20 U	16.00 U	1070.00	3.30	8.20 U	2870.00 U	2.30 U
E. MISSOURI	SMP13-003	07/09/88	0.20 U	15.90 U	2370.00	3.10 U	8.20 U	5970.00	2.30
E. MISSOURI	SMP13-003-N	07/09/88	0.20 U	25.00	890.00	3.90	8.20 U	2870.00 U	2.30 U
TURAH	SMP14-001	07/10/88	0.20 U	15.00 U	2490.00	3.10 U#	8.20 U	5860.00	2.30 U
TURAH	SMP14-001-N	07/10/88	0.20 U	15.00 U	1100.00	3.10 U#	8.20 U	2870.00 U	2.30 U
BONNER	SMP14-002	07/10/88	0.20 U	15.00	2140.00	3.10 U	8.20 U	4250.00	2.30 U

TOTAL RECOVERABLE --- MILLION

SITE NAME	SAMPLE NO	DATE	HE HG BURL	NI OF CUL	W E CURE	SE SE CUL	AG AS CUL	NA N CUL	TH T CUL
E. MISSOULA	CONF14-073	07/10/88	0.20 U	27.50	2075.00	3.10 U	8.20 U	7450.00	2.30 U
E. MISSOULA	CONF14-065 N	07/10/88	0.20 U	16.00 U	535.00	3.10 U	5.20 U	2370.00 U	2.30 U

TOTAL RECOVERABLE --- MILL TOWN

SITE NAME	SAMPLE NO	DATE	VA V CURL	IN I CURL
TURPIN	SWP5-001	06/26/88	14.00 U	11.00 U
BONNER	SWP5-002	06/26/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	06/26/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003-H	06/26/88	14.00 U	11.00 U
PELL GATE	SWP5-004	06/26/88	14.00 U	11.00 U
REEFERE ST.	SWP5-006	06/26/88	14.00 U	11.00 U
SWPFIELDS	SWP5-007	06/26/88	14.00 U	11.00 U
SWPFIELDS	SWP5-008	06/26/88	14.00 U	11.00 U
U. BRIDGE	SWP5-005	06/26/88	14.00 U	11.00 U
TURPIN	SWP5-001	06/27/88	14.00 U	11.00 U
BONNER	SWP5-002	06/27/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	06/27/88	14.00 U	11.00 U
TURPIN	SWP5-001	06/27/88	14.00 U	11.00 U
BONNER	SWP5-002	06/27/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	06/27/88	14.00 U	11.00 U
TURPIN	SWP5-001	06/28/88	14.00 U	11.00 U
BONNER	SWP5-002	06/28/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	06/28/88	14.00 U	11.00 U
TURPIN	SWP5-001	06/29/88	14.00 U	11.00 U
BONNER	SWP5-002	06/29/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	06/29/88	14.00 U	11.00 U
TURPIN	SWP5-001	06/29/88	14.00 U	11.00 U
BONNER	SWP5-002	06/29/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	06/29/88	14.00 U	11.00 U
TURPIN	SWP5-001	06/30/88	14.00 U	11.00 U
BONNER	SWP5-002	06/30/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	06/30/88	14.00 U	11.00 U
TURPIN	SWP5-001	07/01/88	14.00 U	11.00 U
BONNER	SWP5-002	07/01/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	07/01/88	14.00 U	11.00 U
TURPIN	SWP5-001	07/02/88	14.00 U	11.00 U
BONNER	SWP5-002	07/02/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	07/02/88	14.00 U	11.00 U
TURPIN	SWP5-001	07/02/88	14.00 U	11.00 U
BONNER	SWP5-002	07/02/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	07/02/88	14.00 U	11.00 U
TURPIN	SWP5-001	07/02/88	14.00 U	11.00 U
BONNER	SWP5-002	07/02/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	07/02/88	14.00 U	11.00 U
TURPIN	SWP5-001	07/02/88	14.00 U	11.00 U
BONNER	SWP5-002	07/02/88	14.00 U	11.00 U
E. HISSOULA	SWP5-003	07/02/88	14.00 U	11.00 U
TURPIN	SWP5-001	07/02/88	14.00 U	11.00 U

TOTAL RECOVERABLE ---- MILL TONS

SITE NAME	SAMPLE NO	DATE	WH V	QUAL	TP 1	QUAL
ROUNDER	SMP7-002	07/03/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP7-003	07/03/88	14.00	UH	26.40	#* /J*
E. MISSOULA	SMP7-003-H	07/03/88	14.00	UH# /RS	12.00	UH* /U*
TURSH	SMP8-001	07/04/88	14.00	UH	12.00	UH* /U*
ROUNDER	SMP8-002	07/04/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP8-003	07/04/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP8-003-H	07/04/88	14.00	UH	12.00	UH* /U*
TURSH	SMP9-001	07/05/88	14.00	UH	12.00	UH* /U*
ROUNDER	SMP9-002	07/05/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP9-003	07/05/88	14.00	UH	26.50	#* /J*
E. MISSOULA	SMP9-003-H	07/05/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP9-003-H	07/05/88	14.00	U	26.40	*
TURSH	SMP10-001	07/06/88	14.00	UH	15.10	#* /J*
ROUNDER	SMP10-002	07/06/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP10-003	07/06/88	14.00	UH	36.20	#* /J*
TURSH	SMP10-001	07/06/88	14.00	UH	22.80	#* /J*
ROUNDER	SMP10-002	07/06/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP10-003	07/06/88	14.00	UH	26.30	#* /J*
E. MISSOULA	SMP10-003-H	07/06/88	14.00	UH	12.00	UH* /U*
TURSH	SMP11-001	07/07/88	14.00	UH	77.50	#* /J*
ROUNDER	SMP11-002	07/07/88	14.00	UH	12.00	UH* /U*
E. MISSOULA	SMP11-003	07/07/88	14.00	UH	37.40	#* /J*
E. MISSOULA	SMP11-003-H	07/07/88	14.00	UH	12.00	UH* /U*
TURSH	SMP12-001	07/08/88	14.00	U	22.30	*
TURSH	SMP12-001-H	07/08/88	14.00	U	14.70	*
ROUNDER	SMP12-002	07/08/88	14.00	U	12.00	U *
E. MISSOULA	SMP12-003	07/08/88	14.00	U	64.90	*
E. MISSOULA	SMP12-003-H	07/08/88	14.00	U	12.00	U *
TURSH	SMP13-001	07/09/88	14.00	U	17.30	*
TURSH	SMP13-001-H	07/09/88	14.00	U	12.00	U *
ROUNDER	SMP13-002	07/09/88	14.00	U	12.00	U *
E. MISSOULA	SMP13-003	07/09/88	14.00	U	42.80	*
E. MISSOULA	SMP13-003-H	07/09/88	14.00	U	12.00	U *
TURSH	SMP14-001	07/10/88	14.00	U	26.80	*
TURSH	SMP14-001-H	07/10/88	14.00	U	251.00	*
ROUNDER	SMP14-002	07/10/88	14.00	U	105.00	*

TOTAL RECOVERABLE --- MILLION

SITE NO/E	SAMPLE NO	DATE	WV V CUM	IN Z CUM
E. MISCELLA	SMP14-003	07/10/88	14.00 U	102.00 *
E. MISCELLA	SMP14-003-N	07/10/88	14.00 U	12.00 U *

MISSOURI METALS - MILL TON

SITE NAME	SAMPLE NO	IRT NO	DATE	HL HL OUN	SS SS OUN	AS AS CWT	B- GR OUN	FE FE OUN	CO CO OUN	A. Cr. Oun
TURSH	SMPS-001	MHD 337	06/26/88	35.50	29.00 U	4.40	83.29	1.00 U	5.00 U	150.00.00
BOHNER	SMPS-002	MHD 341	06/26/88	35.00 U	29.00 U	2.00 U	124.00	1.00 U	5.00 U	2750.00
E. MISSOURIA	SMPS-003	MHD 343	06/26/88	35.00 U	29.00 U	2.30	126.00	1.00 U	5.00 U	3230.00
E. MISSOURIA	SMPS-003-K	MHD 345	06/26/88	35.00 U	25.00 U	2.50	136.00	1.00 U	5.00 U	3300.00
PELLBATE	SMPS-004	MHD 347	06/26/88	93.60	29.00 U	3.00	132.00	1.00 U	5.00 U	3160.00
U. BRIDGE	SMPS-005	MHD 349	06/26/88	35.00 U	29.00 U	3.10	130.00	1.00 U	5.00 U	3100.00
RESERVE ST.	SMPS-006	MHD 374	06/26/88	35.00 U	29.00 U	2.90	128.00	1.00 U	5.00 U	3000.00
SAHFFIELDS	SMPS-007	MHD 376	06/26/88	35.00 U	29.00 U	2.00 U	131.60	1.00 U	5.00 U	31300.00
TURSH	SMPS-001	MHD 984	06/27/88	35.00 U	29.00 U	4.90	87.00	1.00 U	5.00 U	39100.00
BOHNER	SMPS-002	MHD 985	06/27/88	35.00 U	29.00 U	2.0 U	152.00	1.00 U	5.00 U	30500.00
E. MISSOURIA	SMPS-003	MHD 994	06/27/88	35.00 U	29.00 U	3.00	143.00	1.00 U	5.00 U	34700.00
TURSH	SMPS-001	MHD 982	06/27/88	35.00 U	29.00 U	4.70	87.40	1.00 U	5.00 U	39400.00
BOHNER	SMPS-002	MHD 988	06/27/88	35.00 U	29.00 U	2.0 U	150.00	1.00 U	5.00 U	29500.00
E. MISSOURIA	SMPS-003	MHD 990	06/27/88	35.00 U	29.00 U	2.80	148.00	1.00 U	5.00 U	34900.00
TURSH	SMPS-001	MHD 996	06/28/88	35.00 U	29.00 U	5.00	80.90	1.00 U	5.00 U	40200.00
BOHNER	SMPS-002	MHD 998	06/28/88	35.00 U	29.00 U	2.00 U	152.00	1.00 U	5.00 U	30500.00
E. MISSOURIA	SMPS-003	MHE 329	06/28/88	35.00 U	29.00 U	3.20	143.00	1.00 U	5.00 U	35300.00
E. MISSOURIA	SMPS-003-H	MHE 331	06/28/88	35.00 U	29.00 U	2.00 U	92.00	1.00 U	5.00 U	31.70
TURSH	SMPS-001	MHE 333	06/29/88	35.00 U	29.00 U	5.50	81.00	1.00 U	5.00 U	41500.00
BOHNER	SMPS-002	MHE 335	06/29/88	35.00 U	29.00 U	2.00 U	165.00	1.00 U	5.00 U	31100.00
E. MISSOURIA	SMPS-003	MHE 070	06/29/88	35.00 U	29.00 U	3.00	139.00	1.00 U	5.00 U	34900.00
E. MISSOURIA	SMPS-003-N	MHE 073	06/29/88	35.00 U	29.00 U	2.00 U	2.00 U	1.00 U	5.00 U	57.00
E. MISSOURIA	SMPS-003-N	MHE 072	06/29/88	35.00 U	29.00 U	2.00 U	2.00 U	1.00 U	5.00 U	87.80
TURSH	SMPS-001	MHE 075	06/30/88	35.00 U	29.00 U	4.50	83.50	1.00 U	5.00 U	39200.00
BOHNER	SMPS-002	MHE 077	06/30/88	35.00 U	29.00 U	2.00 U	195.00	1.00 U	5.00 U	29700.00
E. MISSOURIA	SMPS-003	MHE 152	06/30/88	35.00 U	25.00 U	2.50	146.00	1.00 U	5.00	34300.00
E. MISSOURIA	SMPS-003-N	MHE 154	06/30/88	35.00 U	29.00 U	2.40 U	2.00 U	1.00 U	5.00 U	228.00
TURSH	SMPS-001	MHE 156	07/01/88	44.00	29.00 U	4.60	35.10	1.00 U	5.00 U	35600.00
TURSH	SMPS-001-K	MHE 158	07/01/88	35.00 U	29.00 U	4.90	99.70	1.00 U	5.00 U	40800.00
BOHNER	SMPS-002	MHE 160	07/01/88	35.00 U	29.00 U	2.0 U	198.00	1.00 U	5.00 U	29500.00
E. MISSOURIA	SMPS-003	MHF 252	07/01/88	35.00 U	29.00 U	2.80	141.00	1.00 U	5.00 U	34500.00
E. MISSOURIA	SMPS-003-N	MHF 254	07/01/88	35.00 U	29.00 U	2.60 U	2.00 U	1.00 U	5.00 U	44.60 U
TURSH	SMPS-001	MHF 256	07/02/88	35.00 U	29.00 U	5.00	99.60	1.00 U	5.00 U	41600.00
BOHNER	SMPS-002	MHF 258	07/02/88	35.00 U	29.00 U	2.00 U	195.00	1.00 U	5.00 U	31200.00
E. MISSOURIA	SMPS-003	MHF 260	07/02/88	35.00 U	29.00 U	3.50	143.00	1.00 U	5.20	24700.00
E. MISSOURIA	SMPS-003-N	MHF 262	07/02/88	35.00 U	29.00 U	2.00 U	2.60 U	1.00 U	5.00 U	93.00

DISCOVERED METALS --- MILLTOWN

SITE NAME	SAMPLE NO	IRI NO	DATE	AL AL GWT	SS SS GWT	AS AS GWT	SA SS GWT	BE SS GWT	CO CO GWT	CH CH GWT
TURSH	SWP7-001	MH 264	07/03/88	35.00 U	29.00 U	6.20 W	95.90	1.00 U	5.00 U	4050.10
ROMNER	SWP7-002	MH3 092	07/03/88	35.30	29.00 U	2.00 U W	204.00	1.00 U	7.30	2300.00
E. MISSOULA	SWP7-003	MH3 094	07/03/88	35.00 U	29.00 U	3.30	155.00	1.00 U	5.00 U	3540.00
E. MISSOULA	SWP7-003-N	MH6 096	07/03/88	35.00 U	29.00 U	2.30 U	2.37	1.00 U	5.00 U	373.30
TURSH	SWP8-001	MH5 098	07/04/88	35.90	29.00 U	5.30	101.30	1.00 U	5.00 U	4300.00
ROMNER	SWP8-002	MH6 100	07/04/88	35.00 U	29.00 U	2.00 U	199.00	1.00 U	5.00 U	2990.00
E. MISSOULA	SWP8-003	MH3 336	07/04/88	258.00	29.00 U	8.00	159.00	1.00 U	5.00 U	3530.00
E. MISSOULA	SWP8-003-K	MH3 338	07/04/88	35.00 U	29.00 U	2.00 U	2.00 U	1.00 U	5.00 U	219.00
TURSH	SWP9-001	MH3 342	07/05/88	35.00 U	29.00 U	3.10	101.30	1.00 U	5.00 U	4500.00
ROMNER	SWP9-002	MH3 344	07/05/88	35.00 U	29.00 U	2.00 U	105.00	1.00 U	5.00 U	10700.00
E. MISSOULA	SWP9-003	MH3 346	07/05/88	35.00 U	29.00 U	1.50	151.00	1.00 U	5.00 U	25100.00
E. MISSOULA	SWP9-003-M	MH3 348	07/05/88	25.00 U	29.00 U	1.00 U	1.00 U	1.00 U	5.00 U	370.00
E. MISSOULA	SWP9-003-N	MH3 350	07/05/88	35.00 UH	29.00 UH	2.00 UH	2.00 UH	1.00 UH	5.00 UH	210.00
TURSH	SWP10-001	MH3 354	07/06/88	35.00 UH	29.00 UH	5.40	92.70	1.00 UH	5.00 UH	44500.00
ROMNER	SWP10-002	MH3 358	07/06/88	35.00 UH	29.00 UH	2.00 UH	205.00	1.00 UH	5.00 UH	30300.00
E. MISSOULA	SWP10-003	MH3 362	07/06/88	35.00 UH	29.00 UH	3.20	141.00	1.00 UH	5.00 UH	38400.00
TURSH	SWP10-001	MH3 352	07/06/88	35.00 UH	29.00 UH	5.20	90.20	1.00 UH	5.00 UH	42200.00
ROMNER	SWP10-002	MH3 356	07/06/88	35.00 UH	29.00 UH	2.00 UH	201.00	1.00 UH	5.00 UH	29700.00
E. MISSOULA	SWP10-003	MH3 360	07/06/88	35.00 UH	29.00 UH	3.10	185.30	1.00 UH	5.00 UH	38300.00
E. MISSOULA	SWP10-003-N	MH3 364	07/06/88	35.00 UH	29.00 UH	2.00 UH	2.00 UH	1.00 UH	5.00 UH	554.00
TURSH	SWP11-001	MH3 366	07/07/88	35.00 UH	29.00 UH	5.60	95.30	1.00 UH	5.00 UH	44000.00
ROMNER	SWP11-002	MH3 368	07/07/88	35.00 UH	29.00 UH	2.00 UH	193.00	1.00 UH	5.00 UH	29900.00
E. MISSOULA	SWP11-003	MH3 370	07/07/88	35.00 UH	29.00 UH	3.70	154.00	1.00 UH	5.00 UH	38200.00
E. MISSOULA	SWP11-003-N	MH3 372	07/07/88	35.00 UH	29.00 UH	2.00 UH	2.50	1.00 UH	5.00 UH	181.00
TURSH	SWP12-001	MH3 374	07/08/88	26.10	29.00 UH	6.00	97.80	1.00 UH	5.00 UH	43500.00
TURSH	SWP12-001-K	MH3 376	07/08/88	35.00 UH	29.00 UH	6.20	99.50	1.00 UH	5.00 UH	45200.00
ROMNER	SWP12-002	MH3 378	07/08/88	35.00 UH	29.00 UH	2.00 UH	210.00	1.00 UH	5.00 UH	29700.00
E. MISSOULA	SWP12-003	MH3 380	07/08/88	36.20	29.00 UH	3.40	159.00	1.00 UH	5.00 UH	38500.00
E. MISSOULA	SWP12-003-N	MH3 382	07/08/88	35.00 UH	29.00 UH	2.00 UH	2.60	1.00 UH	5.00 UH	131.30
TURSH	SWP13-001	MH3 340	07/09/88	35.00 U	29.00 U	6.90 W	98.50	1.00 U	5.00 U	45200.00
TURSH	SWP13-001-M	MH3 384	07/09/88	35.00 UH	29.00 UH	2.00 UH	2.00 UH	1.00 UH	5.00 UH	42.00
ROMNER	SWP13-002	MH3 386	07/09/88	35.00 UH	29.00 UH	2.00 UH	193.00	1.00 UH	5.00 UH	70400.00
E. MISSOULA	SWP13-003	MH3 388	07/09/88	35.00 UH	29.00 UH	3.30	141.30	1.00 UH	5.00 UH	38500.00
E. MISSOULA	SWP13-003-N	MH3 390	07/09/88	35.00 U	29.00 U	5.00 U	2.50	1.00 U	5.00 U	40.50
TURSH	SWP14-001	MH3 392	07/10/88	35.00 U	29.00 U	6.10	103.00	1.00 U	5.00 U	40400.00
ROMNER	SWP14-002	MH3 394	07/10/88	35.00 U	29.00 U	2.00 U	222.00	1.00 U	5.00 U	21500.00

2. RESOURCES REQUIRED - - - ALL TONS

SITE NAME	SAMPLE NO	TEST NO	DATE	HL AL OUN	SB SB OUN	AS AS OUN	SH SH OUN	EE BE OUN	CO CO OUN	CP CP OUN
E. MISSOULA	SAMP14-003	MMJ 376	07/10/88	35.00 U	29.00 U	3.70	154.00	1.00 U	5.00 U	3936.00
E. MISSOULA	SAMP14-003-K	MMJ 376	07/10/88	35.00 U	29.00 U	5.00	150.00	1.00 U	5.00 U	39500.00
E. MISSOULA	SAMP14-003-A	MMJ 400	07/10/88	35.00 U	29.00 U	2.00 U	2.00 U	1.00 U	5.00 U	96.56

DISSOLVED METALS ---- MILLIGRAM

SITE NAME	SAMPLE NO	IRT NO	DATE	CR CR DUAL	CU CU DUAL	CU CU DUAL	FE FE DUAL	PE FE DUAL	HS MS DUAL	MM MM DUAL
TURAH	SWDS-001	MHD 337	06/26/88	6.00 U	6.00 U	6.10	60.60	3.40	9396.00	7.00 U
BONNER	SWDS-002	MHD 341	06/26/88	6.00 U	6.00 U	6.20	56.00 U	3.00 U	9760.00	7.00 U
E. MISSOULA	SWDS-003	MHD 343	06/26/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	9786.00	21.30
E. MISSOULA	SWDS-003-K	MHD 345	06/26/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	9700.00	21.30
HELLGATE	SWDS-004	MHD 347	06/26/88	6.00 U	6.00 U	6.50	212.00	3.60	9676.00	72.90
U. BRIDGE	SWDS-005	MHD 349	06/26/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	9480.00	14.20
RESERVE ST.	SWDS-006	MHD 374	06/26/88	6.00 U	6.00 U	7.50	57.60	2.00 U	9170.00	10.90
SHUFFIELDS	SWDS-007	MHD 376	06/26/88	6.00 U	6.00 U	6.20	56.00 U	2.00 U	9450.00	11.00
TURAH	SWDS-001	MHD 384	06/27/88	6.00 U	6.00 U	6.00	56.00 U	2.00 U	10400.00	6.70
BONNER	SWDS-002	MHD 386	06/27/88	6.00 U	6.00 U	6.00 U	56.00 U	4.50	10700.60	7.00 U
E. MISSOULA	SWDS-003	MHD 394	06/27/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	10500.00	25.60
TURAH	SWDP-001	MHD 382	06/27/88	6.00 U	6.00 U	6.00 U	91.20	5.30	10400.00	7.00
BONNER	SWDP-002	MHD 388	06/27/88	6.00 U	6.00 U	7.40	56.00 U	7.10	10500.00	7.00 U
E. MISSOULA	SWDP-003	MHD 390	06/27/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	10500.00	22.60
TURAH	SWDP2-001	MHD 396	06/28/88	6.00 U	6.00 U	6.70	56.00 U	2.00 U	10600.00	9.20
BONNER	SWDP2-002	MHD 398	06/28/88	6.00 U	6.00 U	6.00 U	56.00 U	2.50	11300.00	7.00 U
E. MISSOULA	SWDP2-003	MHE 329	06/28/88	6.00 U	6.00 U	6.00 U	56.00 U	3.00	11300.00	30.30
E. MISSOULA	SWDP2-003-N	MHE 331	06/28/88	6.00 U	6.00 U	6.00 U	56.00 U	7.70	71.00 U	7.00 U
TURAH	SWDP3-001	MHE 333	06/29/88	6.00 U	6.00 U	6.00 U	56.00 U	2.40	11300.00	8.10
BONNER	SWDP3-002	MHE 335	06/29/88	6.00 U	6.00 U	6.00 U	56.00 U	5.30	11400.00	7.00 U
E. MISSOULA	SWDP3-003	MHS 070	06/29/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	11100.00	32.60
E. MISSOULA	SWDP3-003-N	MHS 073	06/29/88	6.00 U	6.00 U	6.00 U	56.00 U	5.70	70.00 U	7.00 U
E. MISSOULA	SWDP3-003-N	MHS 072	06/29/88	6.00 U	6.00 U	6.00 U	56.00 U	4.10	70.00 U	7.00 U
TURAH	SWDP4-001	MHS 075	06/30/88	6.00 U	6.00 U	6.00 U	56.00 U	3.40	10200.00	8.80
BONNER	SWDP4-002	MHS 077	06/30/88	6.00 U	6.00 U	6.00 U	56.00 U	6.00	10400.00	7.00 U
E. MISSOULA	SWDP4-003	MHE 152	06/30/88	6.00 U	6.00 U	6.00 U	56.00 U	2.50	10300.00	27.70
E. MISSOULA	SWDP4-003-N	MHS 154	06/30/88	6.00 U	6.00 U	6.00 U	56.00 U	8.90	70.00 U	7.00 U
TURAH	SWDP5-001	MHS 156	07/01/88	6.00 U	6.00 U	6.00 U	56.00 U	5.80	9990.00	16.90
TURAH	SWDP5-001-K	MHS 158	07/01/88	6.00 U	6.00 U	6.00 U	56.00 U	3.00	10600.00	7.00
BONNER	SWDP5-002	MHS 160	07/01/88	6.00 U	6.00 U	6.00 U	56.00 U	2.10	10300.00	7.00 U
E. MISSOULA	SWDP5-003	MHE 252	07/01/88	6.00 U	6.00 U	6.00 U	56.00 U	6.10	11700.00	36.20
E. MISSOULA	SWDP5-003-N	MHE 254	07/01/88	6.00 U	6.00 U	6.00 U	56.00 U	3.10	70.00 U	7.00 U
TURAH	SWDP6-001	MHE 256	07/02/88	6.00 U	6.00 U	6.00 U	56.00 U	6.60	11700.00	8.10
BONNER	SWDP6-002	MHE 258	07/02/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	11800.00	7.00 U
E. MISSOULA	SWDP6-003	MHE 260	07/02/88	6.00 U	6.00 U	6.00 U	56.00 U	3.90	10500.00	4.10
E. MISSOULA	SWDP6-003-N	MHE 262	07/02/88	6.00 U	6.00 U	6.00 U	56.00 U	6.90	70.00 U	7.00 U

019512150 METALS ---- CONTINUED

SITE NAME	SAMPLE NO	TRT NO	DATE	CR CR QUAL	CO CO QUAL	CU CU QUAL	FE FE QUAL	PB PB QUAL	MB MB QUAL	MR MR QUAL
TURBH	SWMP7-001	MH6 254	07/03/88	6.00 U	6.00 U	6.00 U	56.00 U	4.00 5	10700.00	6.10
BOHNER	SWMP7-002	MH6 092	07/03/88	6.00 U	6.00 U	6.10 U	56.00 U	3.10	10600.00	7.00 U
E. MISSOULA	SWMP7-003	MH6 094	07/03/88	6.00 U	6.00 U	13.10	56.00 U	2.30	11100.00	50.40
E. MISSOULA	SWMP7-003-N	MH6 096	07/03/88	6.00 U	6.00 U	11.60	56.00 U	3.60	70.00 U	7.00 U
TURBH	SWMP8-001	MH6 098	07/04/88	6.00 U	6.00 U	15.10	56.00 U	2.80	11600.00	9.00
BOHNER	SWMP8-002	MH6 100	07/04/88	6.00 U	6.00 U	17.30	56.00 U	2.00 U	10700.00	7.30 U
E. MISSOULA	SWMP8-003	MH6 336	07/04/88	6.00 U	6.00 U	24.40	404.00	2.50	11000.00	75.70
E. MISSOULA	SWMP8-003-N	MH6 338	07/04/88	6.00 U	6.00 U	13.20	56.00 U	2.00 U	70.00 U	7.00 U
TURBH	SWMP9-001	MH6 342	07/05/88	6.00 U	6.00 U	11.80	56.00 U	10.20	11900.00	7.00 U
BOHNER	SWMP9-002	MH6 344	07/05/88	6.00 U	6.00 U	3.10	56.00 U	7.90	11100.00	7.00 U
E. MISSOULA	SWMP9-003	MH6 346	07/05/88	6.00 U	6.00 U	10.80	57.40	2.00 U	10900.00	46.00
E. MISSOULA	SWMP9-003-N	MH6 348	07/05/88	6.00 U	6.00 U	9.50	56.00 U	3.30	90.30	7.00 U
E. MISSOULA	SWMP9-003-N	MH6 350	07/05/88	6.00 U#	6.00 U#	9.50	56.00 U#	2.40 #*/J*	70.00 U#	7.30 U#
TURBH	SWMP10-001	MH6 354	07/06/88	6.00 U#	6.00 U#	16.40 #	56.00 U#	4.40 #*/J*	11700.00 #	7.00 U#
BOHNER	SWMP10-002	MH6 358	07/06/88	6.00 U#	6.00 U#	11.50 #	56.00 U#	3.70 #*/J*	11100.00 #	7.00 U#
E. MISSOULA	SWMP10-003	MH6 362	07/06/88	6.00 U#	6.00 U#	17.00 #	56.00 U#	2.70 #M*/J*	10800.00 #	46.60 #
TURBH	SWMP10-004	MH6 362	07/06/88	6.00 U#	6.00 U#	12.30 #	56.00 U#	7.40 #S*/J*	11400.00 #	7.20 #
BOHNER	SWMP10-002	MH6 356	07/06/88	6.00 U#	6.00 U#	16.50 #	56.00 U#	3.00 #*/J*	11000.00 #	7.30 U#
E. MISSOULA	SWMP10-003	MH6 360	07/06/88	6.00 U#	6.00 U#	9.10 #	56.00 U#	4.30 #*/J*	11200.00 #	45.10 #
E. MISSOULA	SWMP10-003-N	MH6 364	07/06/88	6.00 U#	6.00 U#	6.00 U#	56.00 U#	3.30 #*/J*	84.20 #	7.00 U#
TURBH	SWMP11-001	MH6 366	07/07/88	6.00 U#	6.00 U#	16.30 #	56.00 U#	10.30 #+*/J*,E	11300.00 #	7.30 #
BOHNER	SWMP11-002	MH6 368	07/07/88	6.00 U#	6.00 U#	9.00 #	56.00 U#	5.70 #*/J*	10800.00 #	7.00 U#
E. MISSOULA	SWMP11-003	MH6 370	07/07/88	6.00 U#	6.00 U#	6.00 U#	56.00 U#	4.30 #*/J*	12500.00 #	43.60 #
E. MISSOULA	SWMP11-003-N	MH6 372	07/07/88	6.00 U#	6.00 U#	6.00 U#	56.00 U#	3.00 #*/J*	70.00 U#	7.00 U#
TURBH	SWMP12-001	MH6 374	07/08/88	6.00 U#	6.00 U#	11.70 #	56.00 U#	2.00 U#	12300.00 #	7.20 #
TURBH	SWMP12-001-N	MH6 376	07/08/88	6.00 U#	6.00 U#	7.50 #	56.00 U#	2.00 U#M*/J*	12000.00 #	8.80 #
BOHNER	SWMP12-002	MH6 378	07/08/88	6.00 U#	6.00 U#	6.00 U#	56.00 U#	2.30 U#M*/J*	11700.00 #	7.00 U#
E. MISSOULA	SWMP12-003	MH6 380	07/08/88	6.00 U#	6.00 U#	6.00 U#	56.00 U#	3.50 #*/J*	12700.00 #	4.50 #
E. MISSOULA	SWMP12-003-N	MH6 382	07/08/88	6.00 U#	6.00 U#	6.00 U#	56.00 U#	2.00 U#M*/J*	70.00 U#	7.00 U#
TURBH	SWMP13-001	MH6 384	07/09/88	6.00 U	6.00 U	8.50	56.00 U	2.00 U	12300.00	5.70
TURBH	SWMP13-001-N	MH6 384	07/09/88	6.00 U#	6.00 U#	12.60 #	56.00 U#	2.00 U#M*/J*	70.00 U#	7.30 U#
BOHNER	SWMP13-002	MH6 386	07/09/88	6.00 U#	6.00 U#	11.80 #	575.60 #	13.00 #*/J*	10800.00 #	7.30 #
E. MISSOULA	SWMP13-003	MH6 388	07/09/88	6.00 U#	6.00 U#	8.20 #	56.00 U#	6.70 #*/J*	11000.00 #	46.50 #
E. MISSOULA	SWMP13-003-N	MH6 390	07/09/88	6.00 U	6.00 U	6.00 U	56.00 U	2.90	70.00	7.00 U
TURBH	SWMP14-001	MH6 392	07/10/88	6.00 U	6.00 U	7.10	56.00 U	2.00 U	13300.00	10.50
BOHNER	SWMP14-002	MH6 394	07/10/88	6.00 U	6.00 U	6.00 U	56.00 U	2.00 U	12500.00	7.00 U

CONSOLIDATED STATEMENT OF FINANCIAL POSITION

DATE	NAME	SAMPLE NO	IRI NO	DATE	CR CR DUAL	CG CG DUAL	CU CU DUAL	FE FE DUAL	FR FR DUAL	MG MG DUAL	WV WV DUAL
E. MISSOURIA	EMR14-003	MHD 396	07/10/88	6.00 U	6.00 U	6.00 U	6.00 U	66.50	2.00 U	13100.00	75.90
E. MISSOURIA	EMR14-003-K	MHD 392	07/10/88	6.00 U	6.00 U	6.00 U	6.00 U	77.50	3.70	12300.00	77.00
E. MISSOURIA	EMR14-003-N	MHD 400	07/10/88	6.00 U	6.00 U	6.00 U	6.00 U	56.00 L	2.90	70.00 U	7.00 U

DISCOVERED ITEMS --- MULLIN

SITE NAME	SAMPLE NO	IRT NO	DATE	HG HG	WHL	MI MI	GRHL	Y I	GRHL	SE SE	GRHL	AG AG	GRHL	MR M	GRHL	TH T	GRHL
TURFH	SWDS-001	MHD 337	06/26/88	0.20 U	8.00 U	8.00 U	1900.00	2.00 U	4N	4.00 U	8390.00	..00 U	U				
BUNKER	SWDS-002	MHD 341	06/26/88	0.20 U	8.00 U	8.00 U	531.00	2.00 U	W	4.00 U	2610.00	2.00 U	W				
E. MISSOULA	SWDS-003	MHD 343	06/26/88	0.20 U	8.00 U	8.00 U	1310.00	2.00 U	W	4.00 U	5420.00	2.00 U	W				
E. MISSOULA	SWDS-003-K	MHD 345	06/26/88	0.20 U	8.00 U	8.00 U	1270.00	2.00 U	W	4.00 U	5490.00	2.00 U	W				
HELLGATE	SWDS-004	MHD 347	06/26/88	0.20 U	8.00 U	8.00 U	1283.00	2.00 U	W	4.00 U	4710.00	2.00 U	W				
U. BRIDGE	SWDS-005	MHD 349	06/26/88	0.20 U	8.00 U	8.00 U	1439.00	2.00 U	W	4.00 U	5420.00	2.00 U	U				
RESERVE ST.	SWDS-006	MHD 974	06/26/88	0.20 U	8.00 U	8.00 U	1240.00	2.00 U	W	4.00 U	5680.00	2.00 U	W				
SHIFFIELDS	SWDS-007	MHD 976	06/26/88	0.20 U	8.00 U	8.00 U	1290.00	2.00 U	W	4.00 U	5640.00	2.00 U	W				
TURFH	SWDS-001	MHD 984	06/27/88	0.20 U	8.00 U	8.00 U	1620.00	2.00 U	W	4.00 U	8320.00	2.00 U	W				
BUNKER	SWDS-002	MHD 986	06/27/88	0.20 U	8.00 U	8.00 U	1230.00	2.00 U	W	4.00 U	2590.00	2.00 U	W				
E. MISSOULA	SWDS-003	MHD 994	06/27/88	0.20 U	8.00 U	8.00 U	1520.00	2.00 U	W	4.00 U	6740.00	2.00 U	W				
TURFH	SWDP-001	MHD 982	06/27/88	0.20 U	8.00 U	8.00 U	2580.00	2.00 U	W	4.00 U	7480.00	2.00 U	W				
BUNKER	SWDP-002	MHD 988	06/27/88	0.20 U	8.00 U	8.00 U	912.00	2.00 U	W	4.00 U	2890.00	2.00 U	W				
E. MISSOULA	SWDP-003	MHD 990	06/27/88	0.20 U	8.00 U	8.00 U	1972.00	2.00 U	W	4.00 U	6340.00	0.00 U	W				
TURFH	SWDP2-001	MHD 996	06/28/88	0.20 U	8.00 U	8.00 U	2740.00	2.00 U	W	4.00 U	8470.00	2.00 U	W				
BUNKER	SWDP2-002	MHD 998	06/28/88	0.20 U	8.00 U	8.00 U	678.00	2.00 U	W	4.00 U	2370.00	2.00 U	W				
E. MISSOULA	SWDP2-003	MHE 329	06/28/88	0.20 U	8.00 U	8.00 U	1640.00	2.00 U	W	4.00 U	5680.00	2.00 U	W				
E. MISSOULA	SWDP2-003-N	MHE 331	06/28/88	0.20 U	8.00 U	8.00 U	128.00 U	1.00 U		4.00 U	2000.00 U	2.00 U	W				
TURFH	SWDP3-001	MHE 333	06/29/88	0.20 U	8.00 U	8.00 U	2370.00	3.71 U	W	4.00 U	9430.00	2.00 U	W				
BUNKER	SWDP3-002	MHE 335	06/29/88	0.20 U	8.00 U	8.00 U	778.00	1.00 U	W	4.00 U	3660.00	2.00 U	W				
E. MISSOULA	SWDP3-003	MHE 070	06/29/88	0.20 U	8.00 U	8.00 U	1506.00	1.00 U		4.00 U	5430.00	2.00 U	W				
E. MISSOULA	SWDP3-003-N	MHE 073	06/29/88	0.20 U	8.00 U	8.00 U	128.00	1.00 U		4.00 U	2000.00 U	2.00 U	W				
E. MISSOULA	SWDP3-003-M	MHE 072	06/29/88	0.20 U	8.00 U	8.00 U	128.00 U	1.00 U		4.00 U	2600.00 U	2.00 U	W				
TURFH	SWDP4-001	MHE 075	06/30/88	0.20 U	8.00 U	8.00 U	2240.00	2.00 U	W	4.00 U	6400.00	2.00 U	W				
BUNKER	SWDP4-002	MHE 077	06/30/88	0.20 U	8.00 U	8.00 U	812.00	2.00 U		4.00 U	3390.00	2.00 U	W				
E. MISSOULA	SWDP4-003	MHE 152	06/30/88	0.20 U	8.00 U	8.00 U	1510.00	2.00 U	W	4.00 U	5740.00	2.00 U	W				
E. MISSOULA	SWDP4-003-N	MHE 154	06/30/88	0.20 U	8.00 U	8.00 U	186.00 U	2.00 U	W	4.00 U	2000.00 U	2.00 U	W				
TURFH	SWDP5-001	MHE 156	07/01/88	0.20 U	8.00 U	8.00 U	1120.00	2.00 U		4.00 U	8320.00	2.00 U	W				
TURFH	SWDP5-001-K	MHE 158	07/01/88	0.20 U	8.00 U	8.00 U	2190.00	2.00 U	W	4.00 U	8910.00	2.00 U	W				
BUNKER	SWDP5-002	MHE 160	07/01/88	0.20 U	8.00 U	8.00 U	758.00	2.00 U		4.00 U	3060.00	2.00 U	W				
E. MISSOULA	SWDP5-003	MHE 252	07/01/88	0.20 U	8.00 U	8.00 U	3450.00	1.30 U		4.00 U	6150.00	2.00 U	W				
E. MISSOULA	SWDP5-003-N	MHE 254	07/01/88	0.20 U	8.00 U	8.00 U	129.00 U	1.00 U		4.00 U	2000.00 U	2.00 U	W				
TURFH	SWDP6-001	MHE 256	07/02/88	0.20 U	8.00 U	8.00 U	2250.00	1.00 U		4.00 U	9530.00	2.00 U	W				
BUNKER	SWDP6-002	MHE 258	07/02/88	0.20 U	8.00 U	8.00 U	772.00	1.00 U	W	4.00 U	2710.00	2.00 U	W				
E. MISSOULA	SWDP6-003	MHE 260	07/02/88	0.20 U	8.00 U	8.00 U	1440.00	2.00 U	W	4.00 U	5870.00	2.00 U	W				
E. MISSOULA	SWDP6-003-N	MHE 262	07/02/88	0.20 U	8.00 U	8.00 U	129.00 U	2.00 U		4.00 U	2600.00 U	2.00 U	W				

DISCOVER PET-3 ---- MILDOWN

SITE NAME	SAMPLE NO	IRT NO	DATE	HB HB DUPL	MT MT DUPL	U I DUPL	SE SE DUPL	AS AS DUPL	MS M DUPL	TH T DUPL
TURSH	SWP7-001	MH 264	07/07/88	0.20 U	8.00 U	2540.00	2.00 U W	4.00 U	9100.00	2.00 U W
FORNER	SWP7-002	MH 092	07/05/88	0.20 U	8.00 U	724.00	2.00 U	4.00 U	3010.00	2.00 U
E. MISSOULA	SWP7-003	MH 094	07/05/88	0.20 U	0.00 U	1270.00	1.00 U	4.00 U	5510.00	2.00 U W
E. MISSOULA	SWP7-003-N	MH 095	07/05/88	0.20 U	3.00 U	143.00	1.00 U	4.00 U	2000.00 U	2.00 U
TURSH	SWP8-001	MH 098	07/04/88	0.20 U	3.00 U	2910.00	1.00 U	4.00 U	9110.00	2.00 U W
FORNER	SWP8-002	MH 100	07/04/88	0.20 U	8.00 U	615.00	1.00 U W	4.00 U	3000.00	2.00 U
E. MISSOULA	SWP8-003	MH 336	07/04/88	0.20 U	3.00 U	1400.00	1.00 U	4.00 U	5060.00	2.00 U W
E. MISSOULA	SWP8-003-N	MH 338	07/04/88	0.20 U	3.00 U	126.00	1.00 U	4.00 U	2000.00 U	2.00 U
TURSH	SWP9-001	MH 342	07/05/88	0.20 U	8.00 U	2750.00	1.00 U	4.00 U	3920.00	2.60 W
FORNER	SWP9-002	MH 344	07/05/88	0.20 U	5.00 U	574.00	1.00 U W	4.00 U	2710.00	2.40 W
E. MISSOULA	SWP9-003	MH 346	07/05/88	0.20 U	8.00 U	1400.00	1.00 U	4.00 U	5210.00	2.00 U W
E. MISSOULA	SWP9-003-N	MH 348	07/05/88	0.20 U	8.00 U	125.00	1.00 U	4.00 U	2000.00 U	3.20
E. MISSOULA	SWP9-003-N	MH 350	07/05/88	0.20 U#	8.00 U#	176.00 U#	2.00 U#	4.00 U#	2000.00 U#	3.00 U#
TURSH	SWP10-001	MH 354	07/06/88	0.20 U#	3.00 U#	2450.00	2.00 U#W	4.00 U#	9440.00	2.00 U#W
FORNER	SWP10-002	MH 358	07/06/88	0.20 U#	8.00 U#	654.00	2.00 U#	4.00 U#	3340.00	2.00 U#
E. MISSOULA	SWP10-003	MH 362	07/06/88	0.20 U#	8.00 U#	1770.00	2.00 U#W	4.00 U#	5850.00	2.00 U#W
TURSH	SWP10-001	MH 352	07/06/88	0.20 U#	8.00 U#	2150.00	2.00 U#W	4.00 U#	9100.00	2.00 U#W
FORNER	SWP10-002	MH 355	07/06/88	0.20 U#	8.00 U#	645.00	2.00 U#	4.00 U#	2570.00	2.00 U#
E. MISSOULA	SWP10-003	MH 360	07/06/88	0.20 U#	8.00 U#	1470.00	2.00 U#W	4.00 U#	5760.00	2.00 U#W
E. MISSOULA	SWP10-003-N	MH 364	07/06/88	0.20 U#	8.00 U#	125.00	2.00 U#	4.00 U#	2000.00 U#	2.00 U#
TURSH	SWP11-001	MH 366	07/07/88	0.20 U#	8.00 U#	2750.00	2.00 U#W	4.00 U#	10200.00	2.00 U#W
FORNER	SWP11-002	MH 368	07/07/88	0.20 U#	5.00 U#	750.00	2.00 U#	4.00 U#	2000.00 U#	2.00 U#
E. MISSOULA	SWP11-003	MH 370	07/07/88	0.20 U#	8.00 U#	1870.00	1.00 U#	4.00 U#	6210.00	2.00 U#W/U#S
E. MISSOULA	SWP11-003-N	MH 372	07/07/88	0.20 U#	8.00 U#	126.00 U#	1.00 U#	4.00 U#	2000.00 U#	2.00 U#W/U#S
TURSH	SWP12-001	MH 374	07/08/88	0.20 U#	3.00 U#	760.00	1.00 U#W	4.00 U#	9340.00	2.00 U#W/U#S
TURSH	SWP12-001-K	MH 376	07/08/88	0.20 U#	8.00 U#	2650.00	1.00 U#W	4.00 U#	9450.00	2.00 U#W/U#S
FORNER	SWP12-002	MH 378	07/08/88	0.20 U#	3.00 U#	749.00	1.00 U#	4.00 U#	3280.00	2.00 U#W/U#S
E. MISSOULA	SWP12-003	MH 380	07/08/88	0.20 U#	8.00 U#	1510.00	1.00 U#W	4.00 U#	6770.00	2.00 U#W/U#S
E. MISSOULA	SWP12-003-N	MH 382	07/08/88	0.20 U#	8.00 U#	126.00 U#	1.00 U#	4.00 U#	2000.00 U#	2.00 U#W/U#S
TURSH	SWP13-001	MH 340	07/09/88	0.20 U	8.00 U	2540.00	1.00 U	4.00 U	9640.00	2.00 U W
TURSH	SWP13-001-N	MH 384	07/09/88	0.20 U#	8.00 U#	126.00 U#	1.00 U#	4.00 U#	2000.00 U#	2.00 U#W/U#S
FORNER	SWP13-002	MH 385	07/09/88	0.20 U#	8.00 U#	795.00	1.00 U#	4.00 U#	3350.00	2.00 U#W/U#S
E. MISSOULA	SWP13-003	MH 388	07/09/88	0.20 U#	8.00 U#	1700.00	1.00 U#W	4.00 U#	6650.00	2.00 U#W/U#S
E. MISSOULA	SWP13-003-N	MH 390	07/09/88	0.20 U	8.00 U	126.00 U	1.00 U W	4.00 U	2000.00 U	2.00 U W
TURSH	SWP14-001	MH 392	07/10/88	0.20 U	8.00 U	2550.00	1.00 U	4.00 U	10500.00	2.00 U W
FORNER	SWP14-002	MH 394	07/10/88	0.20 U	8.00 U	799.00	1.00 U W	4.00 U	2830.00	2.00 U W

DISSEMINATED METALS - WILLOW

SITE NAME	SAMPLE NO	TR NO	DATE	Hg Hg QUAL	NI NI QUAL	P P QUAL	SE SE QUAL	AG AG QUAL	MA H QUAL	TA T QUAL
E. MISSOULA	SAMPLE 14-003	MHI 396	07/10/88	0.20 U	8.00 U	1850.00	1.00 U	4.00 U	6250.00	2.00 U
E. MISSOULA	SAMPLE 14-003-K MHI 398		07/10/88	0.20 U	8.00 U	1790.00	1.00 U	4.00 U	7050.00	2.00 U
E. MISSOULA	SAMPLE 14-003-M MHI 400		07/10/88	0.20 U	8.00 U	120.00 U	1.00 U	4.00 U	2000.00 U	2.00 U

LIBRARY METALS -- JUL 1989

SITE NAME	SAMPLE NO	IRI NO	DATE	VA V GRWL	ZN Z GRWL
TURAH	SMDS-001	MHD 337	06/26/88	5.00 U	10.40
ROMNER	SMDS-002	MHD 341	06/26/88	5.00 U	9.10
E. MISSOULA	SMDS-003	MHD 343	06/26/88	5.00 U	9.90
E. MISSOULA	SMDS-003-K	MHD 345	06/26/88	5.00 U	4.20
HELLBATE	SMDS-004	MHD 347	06/26/88	5.00 U	7.30
U. BRIDGE	SMDS-005	MHD 349	06/26/88	5.00 U	7.90
RESERVE ST.	SMDS-006	MHD 974	06/26/88	5.00 U	6.10
SHUPFIELDS	SMDS-007	MHD 976	06/26/88	5.00 U	5.40
TURAH	SMDS-001	MHD 984	06/27/88	5.00 U	8.70
ROMNER	SMDS-002	MHD 986	06/27/88	5.00 U	12.00
E. MISSOULA	SMDS-003	MHD 994	06/27/88	5.00 U	11.20
TURAH	SMDS-001	MHD 982	06/27/88	5.00 U	23.00
ROMNER	SMDS-002	MHD 988	06/27/88	5.00 U	18.50
E. MISSOULA	SMDS-003	MHD 990	06/27/88	5.00 U	22.40
TURAH	SMDS-001	MHD 996	06/28/88	5.00 U	16.60
ROMNER	SMDS-002	MHD 998	06/28/88	5.00 U	3.80
E. MISSOULA	SMDS-003	MHE 329	06/28/88	5.00 U	3.00
E. MISSOULA	SMDS-003-N	MHE 331	06/28/88	5.00 U	8.40
TURAH	SMDS-001	MHE 333	06/29/88	5.00 U	24.40
ROMNER	SMDS-002	MHE 335	06/29/88	5.00 U	11.90
E. MISSOULA	SMDS-003	MHG 070	06/29/88	5.00 U	7.30
E. MISSOULA	SMDS-003-M	MHG 073	06/29/88	5.00 U	13.70
E. MISSOULA	SMDS-003-N	MHG 072	06/29/88	5.00 U	4.90
TURAH	SMDS-001	MHG 075	06/30/88	5.00 U	7.30
ROMNER	SMDS-002	MHD 077	06/30/88	5.00 U	6.30
E. MISSOULA	SMDS-003	MHG 152	06/30/88	5.00 U	5.10
E. MISSOULA	SMDS-003-N	MHG 154	06/30/88	5.00 U	5.20
TURAH	SMDS-001	MHG 156	07/01/88	5.00 U	21.90
TURAH	SMDS-001-K	MHE 158	07/01/88	5.00 U	6.20
ROMNER	SMDS-002	MHG 160	07/01/88	5.00 U	6.70
E. MISSOULA	SMDS-003	MHF 252	07/01/88	5.00 U	6.90
E. MISSOULA	SMDS-003-N	MHF 254	07/01/88	5.00 U	3.90
TURAH	SMDS-001	MHF 256	07/02/88	5.00 U	9.90
ROMNER	SMDS-002	MHF 258	07/02/88	5.00 U	30.70
E. MISSOULA	SMDS-003	MHF 260	07/02/88	5.00 U	5.00
E. MISSOULA	SMDS-003-N	MHF 262	07/02/88	5.00 U	5.20

SITE NAME	SAMPLE NO	IRI NO	DATE	Wt g	GRAV	20.2.001
TURAN	SWP7-001	NH 264	07/03/88	5.00 U		10.50
ROMER	SWP7-002	NH 092	07/03/88	5.00 U		6.60
E. MISGULA	SWP7-003	NH 094	07/03/88	5.00 U		9.10
E. MISGULA	SWP7-003-N	NH 096	07/03/88	5.00 U		5.30
TURAN	SWP8-001	NH 098	07/04/88	5.00 U		11.40
ROMER	SWP9-002	NH 100	07/04/88	5.00 U		9.50
E. MISGULA	SWP8-003	NH 336	07/04/88	5.00 U		3.20
E. MISGULA	SWP8-003-N	NH 338	07/04/88	5.00 U		3.50
TURAN	SWP9-001	NH 342	07/05/88	5.00 U		10.40
ROMER	SWP9-002	NH 344	07/05/88	5.00 U		7.20
E. MISGULA	SWP9-003	NH 346	07/05/88	5.00 U		13.30
E. MISGULA	SWP9-003-N	NH 348	07/05/88	5.00 U		8.60
TURAN	SWP10-001	NH 350	07/05/88	5.00 UHN /UJS		9.30 # /3P
ROMER	SWP10-002	NH 352	07/06/88	5.00 UHN /UJS		15.70 # /3P
E. MISGULA	SWP10-003	NH 356	07/06/88	5.00 UHN /UJS		14.50 # /3P
TURAN	SWP10-001	NH 352	07/06/88	5.00 UHN /UJS		0.00 # /3P
ROMER	SWP10-002	NH 356	07/06/88	5.00 UHN /UJS		6.40 # /3P
E. MISGULA	SWP10-003	NH 360	07/06/88	5.00 UHN /UJS		7.60 # /3P
TURAN	SWP11-001	NH 366	07/07/88	5.00 UHN /UJS		8.50 # /3P
ROMER	SWP11-002	NH 368	07/07/88	5.00 UHN /UJS		4.80 # /3P
E. MISGULA	SWP11-003	NH 370	07/07/88	5.00 U		10.10 # /3P
TURAN	SWP12-001	NH 374	07/08/88	5.00 U		12.50 # /3P
E. MISGULA	SWP12-003	NH 382	07/08/88	5.00 U		15.10 # /3P
TURAN	SWP12-001	NH 376	07/08/88	5.00 U		15.10 # /3P
ROMER	SWP12-002	NH 378	07/08/88	5.00 U		9.40 # /3P
E. MISGULA	SWP12-003	NH 380	07/08/88	5.00 U		92.60 # /3P
TURAN	SWP13-001	NH 340	07/09/88	5.00 U		17.10 #
ROMER	SWP13-002	NH 386	07/09/88	5.00 U		18.40 # /3P
E. MISGULA	SWP13-003	NH 388	07/09/88	5.00 U		181.00 # /3P
TURAN	SWP14-001	NH 392	07/10/88	5.00 U		13.10 #
ROMER	SWP14-002	NH 394	07/10/88	5.00 U		12.10 #

SITE NAME	SAMPLE NO	LOT NO	DATE	GR V	GRAL	TOTAL GRAL
E. MISSOURI	SWP14-003	PHJ 396	07/10/88	5.00 U	12.50 *	
E. MISSOURI	SWP14-003-K	PHJ 398	07/10/88	5.00 U	9.50 *	
E. MISSOURI	SWP14-003-N	PHJ 400	07/10/88	5.00 U	10.00 *	

SITE NAME	SAMPLE NO.	DATE	CHLORIDE	SULFATE	ALK	BARREN ALK	ECAR2	TSS
TURAH	SWDS-001	08/12/88	3.16		5 U	103.0		5.3
BOMMER	SWDS-002	08/12/88	0.881 B		5 U	105		3.8
E. MISSOULA	SWDS-003	08/12/88	1.14 B		5 U	101.0		6.7
E. MISSOULA	SWDS-003-K	03/12/88	0.912 B		5 U	105.2		7.2
HELLDALE	SWDS-004	08/12/88	1.21 B		2.40	101.6		5.1
U. SRITREE	SWDS-005	08/12/88	0.78 B		6.0	95.7		6.3
RESEERVE ST.	SWDS-006	08/12/88	0.902 B		9.2	92.3		5.7
SHUFFIELDS	SWDS-007	08/12/88	1.43 B		10.0	91.0		4.3
TURAH	SWDS-001	08/12/88	2.68 B		5 U	106.7		7.7
BOMMER	SWDS-002	08/12/88	0.51 B		5 U	105.2		3.2
E. MISSOULA	SWDS-003	08/12/88	1.32 B		5 U	105.0		6.6
TURAH	SWDS-001	08/12/88	2.2 B		5 U	102.7		4.9
BOMMER	SWDS-002	08/12/88	0.19 B		5 U	104.6		4.1
E. MISSOULA	SWDS-003	08/12/88	1.07 B		5 U	107.0		7.5
BOMMER	SWDS-002	08/12/88	0.59 B		5 U	104.5		3.9
E. MISSOULA	SWDS-003	08/12/88	1.07 B		5 U	102.0		7.8
TURAH	SWDS-001	08/12/88	2.14 B		5 U	110.3		7.1
BOMMER	SWDS-002	08/12/88	0.43 B		6.0	99.1		1.7
E. MISSOULA	SWDS-003	03/12/88	0.94 B		5 U	111.4		0.5
TURAH	SWDS-001	08/12/88	0.1 U		5 U	5 U		11.1
BOMMER	SWDS-002	08/12/88	1.91 B		5 U	77.5		3.0
E. MISSOULA	SWDS-003	08/12/88	0.48 B		5 U	159.0		7.1
E. MISSOULA	SWDS-003	08/12/88	1.15 B		5 U	108.3		7.5
E. MISSOULA	SWDS-003-N	08/12/88	0.1 U		5 U	5 U		0.6
TURAH	SWDS-001	08/12/88	2.31 B		5 U	105.6		3.2
TURAH	SWDS-001-K	08/12/88	2.18 B		5 U	116.0		6.0
BOMMER	SWDS-002	08/12/88	0.39 B		5 U	110.1		2.6
E. MISSOULA	SWDS-003	08/12/88	1.14 B		5 U	113.5		8.8
E. MISSOULA	SWDS-003-N	08/12/88	0.1 U		5 U	5 U		0.0
TURAH	SWDS-001	08/19/88	3.6		49.9	139		7.5
BOMMER	SWDS-002	08/19/88	0.7 B		10	115		7.7
E. MISSOULA	SWDS-003	08/19/88	1.9 B		5 U	140		29
E. MISSOULA	SWDS-003-N	08/19/88	0.5 B		5 U	5 U		0.1
TURAH	SWDS-001	08/19/88	3.3		48.4	170		6.5
BOMMER	SWDS-002	08/19/88	1.0 B		3.4 B	175		7.7

ENTRY MOD. 55 ----- 4/11/88

SITE NAME	SAMPLE NO.	DATE	CHLORIDE	SULFATE	ALK. CAPAC.	ALK. EQ. VSS	TES
E. MISSOULA TURAH	SAMP10-003 SAMP11-001	08/19/88 08/19/88	1.9 B 3.3	17.1 23.4	5 5.0	119 108	28 11
ROUNDER	SAMP11-002	08/19/88	0.4 B	5.48	6.0	122	7.5
E. MISSOULA	SAMP11-003	08/19/88	1.8 B	19.7	5.0	105	24
E. MISSOULA	SAMP11-003-N	08/19/88	0.1 U	3.2 B	5.0	5.0	0.0
TURAH	SAMP6-001	08/19/88	2.7 B	40.5	5.0	116	NR
ROUNDER	SAMP6-002	08/19/88	0.2 B	8.06	5.0	116	NR
E. MISSOULA	SAMP6-003	08/19/88	0.8 B	22.7	5.0	113	NR
E. MISSOULA	SAMP6-003-N	08/19/88	0.1 U	4.0 B	5.0	5.0	NR
TURAH	SAMP7-001	08/19/88	2.1 B	39.1	5.0	121	NR
ROUNDER	SAMP7-002	08/19/88	0.4 B	5.39	6.0	122	NR
E. MISSOULA	SAMP7-003	08/19/88	1.1 B	19.5	5.0	118	NR
E. MISSOULA	SAMP7-003-N	08/19/88	0.1 U	3.2 B	5.0	5.0	NR
TURAH	SAMP8-001	08/19/88	2.1 B	25.8	5.0	120	NR
ROUNDER	SAMP8-002	08/19/88	0.5 B	6.58	5.0	123	NR
E. MISSOULA	SAMP8-003	08/19/88	1.1 B	24.7	5.0	120	NR
E. MISSOULA	SAMP8-003-N	08/19/88	0.1 U	6.18	5.0	5.0	6.6
TURAH	SAMP9-001	08/19/88	2.4 B	40.2	5.0	128	4.2
ROUNDER	SAMP9-002	08/19/88	0.2 B	3.4 B	7.0	118	3.5
E. MISSOULA	SAMP9-003	08/19/88	1.3 B	20.7	5.0	121	25
E. MISSOULA	SAMP9-003-N	08/19/88	0.1 U	3.0 U	5.0	5.0	0.0
E. MISSOULA	SAMP9-003-N	08/19/88	0.4 B	3.0 U	5.0	5.0	0.1
TURAH	SAMP12-001	08/26/88	2.78 B	37.9	136	5.0	7.0
TURAH	SAMP12-001-N	08/26/88	3.28	44.1	170	5.0	7.4
ROUNDER	SAMP12-002	08/26/88	0.75 B	5.53	127	5.0	7.5
E. MISSOULA	SAMP12-003	08/26/88	1.75 B	22.8	128	5.0	77.1
E. MISSOULA	SAMP12-003-N	08/26/88	0.13 B	3.0 U	0.6	5.0	0.0 U
E. MISSOULA	SAMP13-001	03/26/88	2.83 B	43.2	124	3.0	5.9
TURAH	SAMP13-001-N	08/26/88	0.26 B	3.0 U	0.9	5.0	0.0 U
ROUNDER	SAMP13-002	08/26/88	0.44 B	5.0 B	125	5.0	2.4
E. MISSOULA	SAMP13-003	08/26/88	1.58 B	22.9	126	5.0	33.2
E. MISSOULA	SAMP13-003-N	08/26/88	0.1 U	3.0 U	0.2	5.0	0.0 U
TURAH	SAMP14-001	08/26/88	2.79 B	46.5	125	5.0	4.9
TURAH	SAMP14-001-N	08/26/88	0.62 B	4.1 B	135	5.0	4.0
ROUNDER	SAMP14-002	08/26/88	1.42 B	23.4	128	5.0	61.7
E. MISSOULA	SAMP14-003	08/26/88	1.45 B	23.9	135	5.0	61.7

SITE NAME	SAMPLE NO.	DATE	CHLORIDE	SULFATE	ALK. CAPAC. ML	CHLORIDE TSS
E. MISSOURIA	SAMP14-003-N	08/26/88	0.1 U	3.0 U	0.3	5 U
						6.0 U

SEDIMENT RAW DATA

APPENDIX 5.2.2

WILLIAMS SECTION, WAL 115

SAMPLE NO	TR NO	DATE	ML AL GRAL	SB SB DATA	MS AS DATA	SS GR GRAL	BE BE DATA	CD CD DATA	CA CA DATA	CR CR DATA
SD-SRB-A	MHP 703	10/17/88	10900.00	4.50 U N	73.00	420.00	0.84	3.60	33300.10	14.70
SD-DRB-B	MHD 289	10/17/88	4140.00	4.20 U N	7.50	130.00	0.72	0.59 U	3400.00	12.90
SD-DRB-A	MHP 302	10/17/88	9030.00	4.50 U N	24.70	640.00	1.10	2.70	35100.00	13.30
SE-DRB-B	MHD 288	10/17/88	4020.00	4.30 U N	5.90	124.00	0.77	0.60 U	3770.00	7.90
SD-FE2-E-A	MHP 309	11/11/88	10200.00	8.00 N	25.50	478.00	1.10	3.70	56700.00	14.40
SD-TR1-A-A	MHP 304	10/18/88	10500.00	8.20 N	30.40	510.00	1.10	3.60	37100.00	12.10
SD-TR1-B-B	MHD 290	10/18/88	4210.00	9.00 N	7.10	95.00	0.72	1.00	4140.00	8.00
SD-TR1-B-A	MHP 305	10/18/88	11200.00	8.50 N	32.10	505.00	1.20	2.00	35700.00	14.60
SD-TR1-B-B	MHD 291	10/18/88	5380.00	8.70 N	1.00	127.00	0.45	1.50	7670.00	3.10
SD-TR1-C-A	MHP 306	10/18/88	8310.00	7.10 N	12.10	253.00	1.10	0.92	8750.00	11.50
SD-TR1-C-B	MHD 292	10/18/88	7610.00	4.90 N	14.50	153.00	1.10	1.20	5670.00	8.20
SD-TR1-D-A	MHP 307	10/18/88	13700.00	7.50 N	0.80	257.00	1.10	0.94	4600.00	16.10
SD-TR1-D-B	MHD 293	10/18/88	8440.00	7.20 N	5.30	130.00	1.10	0.60 U	2770.00	10.80
SD-TR2-A-A	MHD 294	10/18/88	4020.00	7.00 N	8.30	87.30	0.76	1.10	6540.00	7.20
SD-TR2-A-B	MHP 308	10/18/88	11000.00	0.30 N	23.10	492.00	1.30	4.90	50500.00	13.10
SD-TR2-B-B	MHD 295	10/18/88	3350.00	5.00 N	5.20	112.00	0.75	0.87	5500.00	5.30
SD-TR2-C-A	MHP 310	10/18/88	13200.00	8.50 N	8.90	735.00	1.10	0.71	39500.00	12.80
SD-TR2-C-B	MHD 296	10/18/88	7960.00	9.50 N	23.90	715.00	1.10	2.40	5990.00	8.40
SD-TR2-D-A	MHP 311	10/18/88	8450.00	7.10 N	25.50	800.00	1.30	2.20	7410.00	11.30
SD-TR2-D-B	MHD 297	10/18/88	8160.00	9.50 N	7.30	210.00	1.10	0.69	22700.00	10.10
SD-TR3-A-A	MHP 315	10/18/88	10700.00	4.60 U N	23.10	433.00	1.30	4.10	55100.00	10.30
SD-TR3-A-B	MHD 701	10/18/88	3660.00	4.40 U N	5.90	77.40	0.40	0.89	4150.00	4.40
SD-TR3-B-B	MHP 312	10/18/88	6290.00	10.20 N	20.50	465.00	1.10	5.00	70100.00	9.80
SD-TR3-A1-B	MHD 298	10/18/88	3320.00	4.00 U N	5.40	54.40	0.19 U	0.51 U	3000.00	5.10
SD-TR3-B-A	MHP 316	10/18/88	11400.00	4.60 U N	21.50	259.00	1.20	3.90	23900.00	11.70
SD-TR3-B-B	MHD 702	10/18/88	8620.00	4.20 U N	18.50	243.00	1.00	2.30	13800.00	11.10
SD-TR3-B1-A	MHP 313	10/18/88	5680.00	4.50 U N	15.50	814.00	1.30	4.10	59700.00	7.40
SD-TR3-B1-B	MHD 299	10/18/88	2950.00	7.00 N	5.50	57.30	0.35	0.72	2490.00	5.50
SD-TR3-C-A	MHP 314	10/18/88	9030.00	4.50 U N	21.30	302.00	1.10	3.40	9070.00	5.80
SD-TR3-C-B	MHD 300	10/18/88	7490.00	8.30 N	18.70	511.00	1.10	2.50	5130.00	10.10
SD-TR3-D-A	MHP 317	10/18/88	16500.00	4.50 U N	7.70	27.30	1.20	0.65	3040.00	7.90
SD-TR3-D-B	MHD 703	10/18/88	14700.00	4.90 N	8.50	222.00	1.10	0.59	2400.00	8.40
SD-TR4-A-A	MHP 318	10/19/88	7450.00	4.50 U N	19.70	570.00	1.10	3.70	96200.00	11.90
SD-TR4-A-B	MHD 714	10/19/88	3030.00	4.30 U N	4.60	83.40	0.18 U	0.77	5770.00	2.30
SD-TR4-A1-A	MHP 319	10/19/88	7680.00	4.50 U N	20.70	429.00	1.20	2.90	29000.00	10.80
SD-TR4-A1-B	MHD 705	10/19/88	3540.00	4.40 U N	4.90	73.30	0.19 U	0.73	2510.00	4.70

MTL-TWR, SEATTLE P.H. 615

SAMPLE NO	ITS NO	DATE	HL	FL	Q.ML	SS	SS	Q.ML	AS	AS	Q.ML	BS	BS	Q.ML	BE	BE	Q.ML	CD	CD	Q.ML	CA	CA	Q.ML	CS	CS	Q.ML
SD-TR4-AJ	MHD 283	11/09/88	17.40	U		22.10	U		1.30	U		1.00	U		0.50	U		3.10	U		38.00	U		6.00	U	
SD-TR4-B-A	MHP 320	10/19/88	6230.00			4.40	U N		15.60			485.00			1.20			1.40			7020.00			6.50		
SD-TR4-B-B	MHD 706	10/19/88	3230.00			4.30	U N		4.50			96.90			0.39			0.69			2740.00			5.80		
SD-TR4-C-A	MHP 321	10/19/88	8940.00			4.20	U N		14.90			1160.00			1.20			1.80			10400.00			9.30		
SD-TR4-C-B	MHD 707	10/19/88	6040.00			5.30	N		10.10	B		682.00			1.20			1.40			6240.00			6.70		
SD-TR4-D-A	MHP 322	10/19/88	8760.00			4.50	U N		17.00			806.00			1.20			2.50			11400.00			9.80		
SD-TR4-D-B	MHD 705	10/19/88	6510.00			4.20	U N		14.90			611.00			1.20			1.90			7340.00			6.00		
SD-TR4-E-A	MHP 327	10/19/88	9720.00			4.60	U N		11.50			451.00			1.30			1.60			12900.00			11.80		
SD-TR4-E-B	MHD 709	10/19/88	6360.00	##		4.40	U##N	FR-B	9.40	#		225.00	#		0.61	B		1.30	#		9640.00	#		8.70	#	
SD-TR4-F-A	MHP 329	10/20/88	16200.00			4.70	U		4.70	B		374.00			1.10			0.66	U		28800.00			8.30		
SD-TR4-F-B	MHD 715	10/20/88	14900.00	##		4.60	U##N	FR-E	5.10	#		473.00	#		1.30	#		0.64	U##		25300.00	#		5.70	#	
SD-TR5-A-A	MHP 324	10/19/88	12100.00	*		4.60	U N		25.30			482.00			1.20			3.30			38000.00			15.10		
SD-TR5-A-B	MHD 710	10/19/88	4050.00	*		4.40	U N		7.30			120.00			0.13	U		0.88			3300.00			6.70		
SD-TR5-B-A	MHP 320	10/20/88	9630.00	*		4.40	U N		22.90			450.00			1.20			3.20			37600.00			11.20		
SD-TR5-B-B	MHD 716	10/20/88	4650.00			4.30	U N		7.10			134.00			0.18	U		0.61	U		7610.00			6.30		
SD-TR5-C-A	MHP 325	10/19/88	12000.00	*		4.60	U N		24.60			309.00			1.10			2.60			38100.00			14.90		
SD-TR5-C-B	MHD 711	10/19/88	6500.00	*		4.30	U N		0.40			189.00			0.65			1.60			8470.00			7.00		
SD-TR5-D-A	MHD 331	10/20/88	10700.00	*		5.20	U N		30.00			442.00			1.40			3.50			48300.00			11.70		
SD-TR5-D-B	MHD 717	10/20/88	7980.00			4.90	U N		21.50			288.00			1.30			1.80			28600.00			9.20		
SD-TR5-E-A	MHP 326	10/19/88	7020.00	*		4.50	U N		21.20			473.00			1.20			1.30			7950.00			11.40		
SD-TR5-E-B	MHD 712	10/19/88	5430.00	*		4.50	U N		13.20			209.00			0.54			1.70			4010.00			3.50		
SD-TR5-F-A	MHP 332	10/20/88	8560.00	*		5.70	N		14.70			236.00			1.30			1.70			9230.00			12.60		
SD-TR5-F-B	MHD 718	10/20/88	5270.00			4.40	U N		9.00			97.40			0.18	U		0.62	U		3490.00			2.60		
SD-TR5-G-A	MHP 327	10/19/88	10700.00	*		4.50	U N		8.90			256.00			1.20			0.63	U		4660.00			12.90		
SD-TR5-G-B	MHD 713	10/19/88	7360.00			4.40	U N		3.60			137.00			0.94			0.62	U		2910.00			7.50		
SD-TR6-A-A	MHP 336	10/20/88	8160.00	*		4.50	U N		22.30			337.00			1.20			2.00	E		14500.00			16.90		
SD-TR6-A-B	MHD 722	10/20/88	3330.00			4.20	U N		6.20			58.50			0.17	U		0.59	U		1760.00			5.20		
SD-TR6-A-C	MHD 723	10/20/88	3590.00			4.40	U N		7.50			83.60			0.12	U		0.75			3570.00			7.20		
SD-TR6-A-D	MHP 337	10/20/88	6900.00	*		4.50	U N		26.30			337.00			1.20			6.20			51600.00			19.50		
SD-TR6-A-E	MHD 724	10/20/88	5380.00	*		4.50	U N		11.20			517.00			0.79			2.10			70800.00			29.80		
SD-TR6-B-A	MHP 334	10/20/88	4230.00			4.30	U N		6.60			114.00			0.18	U		0.61	U		8520.00			6.30		
SD-TR6-B-B	MHD 720	10/20/88	4230.00			4.40	U N		35.20			2560.00			1.20			2.90			7250.00			12.60		
SD-TR6-C-A	MHP 338	10/20/88	9830.00	*		4.30	U N		24.30			854.00			1.20			1.90			5070.00			6.30		
SD-TR6-C-B	MHD 724	10/20/88	7570.00			4.40	U N		37.70			394.00			1.20			3.20			7190.00			11.00		

WILLIAMS EELMENT ANALYSIS

SAMPLE NO	TR NO	DATE	AL AL GUM	SS SS GUM	AS AS GUM	Bt Pt GUM	St BE GUM	CD CD GUM	CA OR GUM	CP CS GUM
SD-TR5-C1-B	TR4 721	10/20/88	6310.00	4.40 U R	23.70	204.00	(.53	1.70	4110.00	7.20
SD-TR5-CK-A	TR4 737	10/20/88	10400.00	4.50 U R	23.50	2400.00	1.20	3.00	7410.00	11.30
SD-TR6-CK-B	TR4 725	10/20/88	7350.00	4.40 U R	29.50 E	1010.00	1.20	2.10	5160.00	9.20
SD-TR6-D-A	TR4 740	10/20/88	10500.00	4.50 U R	41.70	225.00	1.20	1.40	6750.00	12.10
SD-TR6-D-B	TR4 726	10/20/88	10800.00	4.40 U R	24.60	218.00	1.20	0.62 U	5400.00	12.50
SD-TR6-DI	TR4 784	11/09/88	17.40 U	22.10 U	2.30 U	2.00 U	(.90 U	3.10 U	38.00 U	8.00 U

MILLTOWN ECCL ANALYSIS --- PAGE 2

SAMPLE NO	TR NO	DATE	K K GURL	SE SE GURL	AS AS GURL	MS MS GURL	TH TH GURL	VA VA GURL	Z Z GURL
50-001	MHP 342	10/26/88	2180.00 #	0.85 #H+/J05	0.84 UH	441.30 #	0.32 UHMS/RS	22.10 #	69.80 #
50-001-F	MHI 301	11/04/85	47.00 U	36.30 5	14.90	71.50	40.30 5	61.00	163.00 E
50-002	MHP 343	10/26/88	2170.00 #	1.50 #H+/FE	0.74 UH	423.00 #	0.30 UHMS/RS	20.30 #	51.70 #
50-003	MHP 344	10/26/88	2970.00 #	1.70 #H+/FE	0.80 UH	158.00 #	0.31 UHMS/RS	14.30 #	56.20 #
50-004	MHP 345	10/26/88	2540.00 #	0.65 #H+/J05	0.83 UH	73.40 #	0.30 UHMS/RS	18.60 #	58.50 #
50-005	MHP 346	10/26/88	2300.00 #	1.30 #H5/J5	0.79 UH	63.10 #	0.29 UHMS/RS	14.30 #	60.40 #
50-006	MHP 347	10/26/88	3040.00 #	0.91 #H5/J5	0.76 UH	79.70 #	0.29 UHMS/RS	15.90 #	61.80 #
50-007	MHP 348	10/26/88	1530.00 #	0.61 #H+/J5E	0.83 UH	122.00 #	0.30 UHMS/RS	14.70 #	41.30 #
50-007-K	MHP 349	10/26/88	1540.00 #	1.60 #H+/FE	0.81 UH	119.00 #	0.30 UHMS/RS	13.70 #	40.80 #
50-008	MHP 350	10/26/88	2030.00 #	0.97 #H+/FE	0.84 UH	151.30 #	0.31 UHMS/RS	18.10 #	40.90 #
50-009	MHP 351	10/26/88	2440.00 #	0.50 #H+/J05	0.82 UH	154.00 #	0.31 UHMS/RS	17.60 #	49.50 #
50-010	MHP 352	10/26/88	1720.00 #	0.70 #HMS/J5	0.79 UH	50.60 #	0.29 UHMS/RS	18.80 #	52.90 #
50-011	MHP 353	10/26/88	1480.00 #	0.91 UHMS/RS	0.76 UH	71.30 #	0.30 UHMS/RS	18.20 #	45.90 #
50-012	MHP 354	10/26/88	1640.00 #	1.10 #H+/J5E	0.76 UH	78.10 #	0.29 UHMS/RS	16.00 #	48.00 #
50-012-J	MHI 247	10/28/88	236.00 U	2.30 N	3.70 U	121.00 U	1.40 U H	2.80 U	11.70 U
50-013	MHP 355	10/26/88	2050.00 #	0.67 #HMS/J5	0.77 UH	101.00 #	0.29 UHMS/RS	17.00 #	44.70 #
50-014	MHP 356	10/26/88	2000.00 #	1.80 #H+/FE	0.79 UH	57.30 #	0.29 UHMS/RS	20.20 #	38.80 #
50-015	MHP 357	10/26/88	1660.00 #	0.56 #HMS/J5	0.73 UH	98.40 #	0.28 UHMS/RS	19.20 #	33.90 #
50-016	MHP 358	10/26/88	2810.00 #	0.95 #H+/FE	0.74 UH	94.10 #	0.28 UHMS/RS	21.40 #	42.10 #
50-017	MHP 359	10/26/88	2590.00 #	0.55 #HMS/J5	0.77 UH	55.50 #	0.29 UHMS/RS	18.50 #	35.00 #
50-018	MHP 360	10/26/88	2380.00 #	1.30 #H+/J5E	0.75 UH	59.70 #	0.27 UHMS/RS	21.30 #	37.90 #
50-019	MHP 364	10/27/88	2670.00	0.66 H+	0.84 U	111.00	0.30 U H	23.20	74.50
50-020	MHP 365	10/27/88	2460.00	0.54 H	0.88	102.00	1.50 U H	22.80	66.90
50-021	MHP 366	10/27/88	2350.00	0.48 H	0.80 U	87.50	0.30 U H	20.90	67.60
50-022-A	MHP 367	10/27/88	2940.00	1.00 H	0.72	98.00	0.29 U H	23.10	61.60
50-022-9	MHP 368	10/27/88	2330.00	0.54 H	0.76 U	94.10	0.28 U H	18.60	44.10
50-023-0	MHP 370	10/27/88	2340.00	0.49 H	0.79 U	96.40	0.26 H	20.40	54.60
50-023-B	MHP 369	10/27/88	2160.00	0.52 H	0.76 U	88.30	0.25 U H	19.00	39.20
50-024-A	MHP 371	10/27/88	2280.00	0.55 H	0.78 U	97.70	0.30 H	21.50	53.30
50-024-9	MHP 372	10/27/88	1830.00	0.61 H	0.76	73.95	0.29 U H	17.00	42.40
50-025	MHI 275	10/27/88	2180.00	0.67 +	1.20	37.50	0.29 U H	20.00	58.70
50-025-4	MHI 230	10/27/88	2260.00	0.47 +	0.77 U	88.20	0.29 U H	20.90	58.00
50-026	MHP 361	10/27/88	1720.00 #	0.45 UHMS/RS	0.75 UH	85.90 #	0.29 UHMS/RS	19.10 #	36.00 #
50-027	MHP 362	10/27/88	2070.00	0.45 +	0.76 U	81.70	0.22 H	15.70	49.60
50-027-J	MHI 272	10/27/88	226.00 U	2.10 UH	3.30 UH	121.00 UH	1.10 UH	2.30 UH	11.70 UH
50-028	MHP 363	10/27/88	2050.00	0.62 H	0.71 U	65.40	0.29 U H	19.70	61.20

MILL TOWN FEDERMENT ANALYSIS

SAMPLE NO	TR NG	DATE	CU CU QUAL	FE FE QUAL	PG PG QUAL	MG MG QUAL	MM MM QUAL	MS MS QUAL	MI MI QUAL
SD-TR6-A	MHP 303	10/17/88	7.00	248.00		5410.00	1040.00	0.73 N	10.10
SD-TR6-B	MHP 259	10/17/88	3.40	56.50	*	2610.00	200.00	0.09 U N	5.20
SD-TR6-A	MHP 302	10/17/88	5.80	259.00	*	6220.00	796.00	0.44 N	9.40
SD-TR6-B	MHP 288	10/17/88	3.90	52.60	*	2650.00	232.00	0.31 N	4.90
SD-FE2-R-A	MHP 309	11/11/88	7.80	302.00	*E	5290.00	822.00	0.62	9.90
SD-TR1-A-A	MHP 304	10/18/88	7.50	360.00	*E	5290.00	725.00	0.56	9.00
SD-TR1-A-B	MHP 290	10/18/88	5.40	140.00	*E	2610.00	235.00	0.10 U	6.90
SD-TR1-B-A	MHP 305	10/18/88	6.50	230.00	*E	5570.00	528.00	0.58	9.50
SD-TR1-B-B	MHP 271	10/18/88	5.10	110.00	*E	3770.00	263.00	0.10 U	6.70
SD-TR1-C-A	MHP 306	10/18/88	7.20	134.00	*E	6260.00	451.00	0.30	10.90
SD-TR1-C-B	MHP 292	10/18/88	6.60	96.30	*E	5360.00	390.00	0.25	7.90
SD-TR1-D-A	MHP 307	10/18/88	7.60	14.70	*E	5150.00	385.00	0.10 U	10.80
SD-TR1-D-B	MHP 293	10/18/88	5.50	12.30	*E	3490.00	248.00	0.11 U	7.20
SD-TR2-A-A	MHP 294	10/18/88	4.90	61.50	*E	3360.00	402.00	0.09 U	5.90
SD-TR2-A-B	MHP 308	10/18/88	8.60	377.00	*E	5920.00	2060.00	0.80	9.90
SD-TR2-E-B	MHP 295	10/18/88	3.90	48.50	*E	2170.00	169.00	0.10 U	5.00
SD-TR2-C-A	MHP 310	10/18/88	5.80	30.00	*E	9490.00	326.00	0.09 U	10.20
SD-TR2-C-B	MHP 296	10/18/88	7.80	199.00	*E	5680.00	847.00	0.20	8.10
SD-TR2-D-A	MHP 311	10/18/88	8.10	150.30	*E	6720.00	989.00	0.24	10.00
SD-TR2-D-B	MHP 297	10/18/88	5.20	16.40	*E	6660.00	284.00	0.09 U	9.40
SD-TR3-A-A	MHP 315	10/18/88	8.00	352.00	E	5920.00	1320.00	0.77	9.60
SD-TR3-A-B	MHP 701	10/18/88	4.10	54.20	E	2690.00	237.00	0.09 U	5.20
SD-TR3-A1-B	MHP 312	10/18/88	8.10	202.00	*E	4546.00	2570.00	0.28	9.20
SD-TR3-A1-B	MHP 298	10/18/88	3.70	37.40	*E	2450.00	262.00	0.10 U	4.80
SD-TR3-B-B	MHP 316	10/18/88	7.30	506.00	E	5780.00	688.00	1.00	9.60
SD-TR3-B-B	MHP 702	10/18/88	8.20	354.00	E	5120.00	579.00	0.68	10.20
SD-TR3-E1-B	MHP 313	10/18/88	5.50	250.00	E	3960.00	1220.00	0.38	6.60
SD-TR3-E1-B	MHP 299	10/18/88	3.30	32.40	*E	1990.00	192.00	0.09 U	3.90
SD-TR3-E1-B	MHP 314	10/18/88	9.00	251.00	E	6760.00	1080.00	0.36	11.20
SD-TR3-C-B	MHP 300	10/18/88	8.10	183.00	*E	5190.00	750.00	0.21	10.00
SD-TR3-E-A	MHP 317	10/18/88	8.10	32.70	E	5200.00	504.00	0.11 U	9.50
SD-TR3-D-B	MHP 703	10/18/88	8.20	22.40	E	5260.00	500.00	0.10 U	9.70
SD-TR4-A-A	MHP 318	10/19/88	7.30	294.00	E	5290.00	2850.00	0.61	11.30
SD-TR4-A-B	MHP 704	10/19/88	7.50	31.30	E	2560.00	331.00	0.10 U	3.70
SD-TR4-A1-B	MHP 319	10/19/88	5.20	2.0.00	E	4940.00	762.00	0.49	9.90
SD-TR4-A1-B	MHP 705	10/19/88	4.10	39.70	E	2620.00	107.00	0.09 U	4.50

MILLTOWN SEDIMENT ANALYSIS

SAMPLE NO	ITR NO	DATE	CO CO QNAL	CU CU QNAL	FE FE QNAL	PB PB QNAL	MS MS QNAL	MN MN QNAL	HS HS QNAL	NI NI QNAL
ED-TR6-E1-B	MHD 721	10/20/88	6.00	191.00 *E	10500.00	41.70	4210.00	652.00	0.21	9.00
ED-TR6-C1-B	MHP 739	10/20/88	9.10	297.00 E	14600.00 E	57.50 N	6790.00	1160.00 E	0.54	12.30
ED-TR6-E1-E	MHD 725	10/20/88	6.00	226.00 *E	11500.00	48.10 S	4730.00	789.00	0.29	9.30
SD-TR6-D-4	MHP 740	10/20/88	5.70	261.00 E	13500.00 E	45.90 N	5430.00	372.00 E	0.59	10.90
SD-TR6-D-6	MHD 726	10/20/88	6.40	369.00 *E	13800.00	79.50	5940.00	354.00	0.50	10.50
SD-TR6-DJ	MHD 784	11/09/88	8.70 U	4.50 U	22.50 U	1.50 U	53.50 U	1.80 U	0.20 U	15.70 U

MILLTOWN SEDIMENT ANALYSIS

SAMPLE NO	ITR NO	DATE	CO CO DUPL	CU CU DUPL	FE FE DUPL	PE PE DUPL	MG MG DUPL	NH NH DUPL	MG MG DUPL	NI NI DUPL
SD-GR-B	MHP 303	10/17/88	7.00	349.00	13100.00	57.10	5410.00	1040.00	0.73 N	10.10
SD-GR-B	MHP 289	10/17/88	3.40	56.50 *	7980.00	16.50	2610.00	200.00	0.09 U N	5.20
SD-GR-B	MHP 302	10/17/88	5.80	259.00 *	11600.00	57.90	5220.00	796.00	0.44 N	9.40
SD-GR-B	MHP 288	10/17/88	3.90	52.60 *	7480.00	15.10 S	2650.00	232.00	0.31 N	4.90
SD-FE2-B-A	MHP 309	11/11/88	7.80	302.00 *E	12600.00	59.40	5250.00	822.00 N	0.62	9.90
SD-TR1-A-A	MHP 304	10/18/88	7.50	360.00 *E	13200.00	54.00	5750.00	725.00 N	0.56	9.00
SD-TR1-A-B	MHP 290	10/18/88	5.40	140.00 *E	8150.00	14.90 S	2610.00	235.00 N	0.10 U	6.90
SD-TR1-B-A	MHP 305	10/18/88	6.50	350.00 *E	14300.00	47.40	5670.00	528.00 N	0.58	9.50
SD-TR1-B-B	MHP 291	10/18/88	5.10	110.00 *E	9310.00	19.20	3770.00	263.00 N	0.10 U	6.70
SD-TR1-C-A	MHP 306	10/18/88	7.20	134.00 *E	12500.00	37.40	6280.00	451.00 N	0.30	10.90
SD-TR1-C-B	MHP 292	10/18/88	6.60	98.30 *E	11900.00	24.10	5380.00	390.00 N	0.25	7.90
SD-TR1-D-A	MHP 307	10/18/88	7.60	14.70 *E	16400.00	11.30 S	5150.00	385.00 N	0.10 U	10.80
SD-TR1-D-B	MHP 293	10/18/88	5.50	12.20 *E	11300.00	7.40	3450.00	248.00 N	0.11 U	7.30
SD-TR2-A-A	MHP 294	10/18/88	4.90	61.50 *E	8740.00	23.00	3360.00	402.00 N	0.09 U	5.90
SD-TR2-B-B	MHP 308	10/18/88	8.60	377.00 *E	13700.00	65.30	5930.00	2060.00 N	0.80	9.90
SD-TR2-B-B	MHP 295	10/18/88	3.90	48.50 *E	7270.00	65.70	2170.00	169.00 N	0.10 U	5.00
SD-TR2-C-A	MHP 310	10/18/88	5.80	30.00 *E	14400.00	19.40	9490.00	326.00 N	0.09 U	10.30
SD-TR2-C-B	MHP 296	10/18/88	7.80	199.00 *E	12900.00	37.20	5880.00	847.00 N	0.20	8.10
SD-TR2-D-A	MHP 311	10/18/88	8.10	190.00 *E	13500.00	42.10	6720.00	989.00 N	0.24	10.00
SD-TR2-D-B	MHP 297	10/18/88	5.20	16.40 *E	10700.00	11.70	6960.00	284.00 N	0.09 U	9.40
SD-TR3-A-A	MHP 315	10/18/88	8.00	352.00 E	12500.00	57.50	5930.00	1320.00	0.77	9.60
SD-TR3-A-B	MHP 701	10/18/88	4.10	54.20 E	6910.00	14.30	2490.00	237.00	0.09 U	5.20
SD-TR3-A-B	MHP 312	10/18/88	8.10	202.00 *E	8920.00	51.70	4540.00	2570.00 N	0.28	9.20
SD-TR3-A-B	MHP 298	10/18/88	3.70	37.40 *E	7490.00	16.40	2450.00	262.00 N	0.10 U	4.80
SD-TR3-B-A	MHP 316	10/18/88	7.30	508.00 E	15000.00	80.30	5780.00	888.00	1.00	9.60
SD-TR3-B-B	MHP 702	10/18/88	8.20	354.00 E	13600.00	59.30	5120.00	579.00	0.68	10.30
SD-TR3-B-B	MHP 313	10/18/88	5.50	250.00 E	6980.00	44.60	3960.00	1220.00	0.38	6.60
SD-TR3-B-B	MHP 299	10/18/88	3.30	32.40 *E	6050.00	11.20 S	1890.00	192.00 N	0.09 U	3.90
SD-TR3-C-A	MHP 314	10/18/88	9.00	231.00 E	13600.00	45.30	6700.00	1080.00	0.36	11.20
SD-TR3-C-B	MHP 300	10/18/88	8.10	193.00 *E	12500.00	54.90	5180.00	750.00 N	0.21	10.00
SD-TR3-C-B	MHP 317	10/18/88	8.10	37.70 E	17100.00	14.50 S	5200.00	504.00	0.11 U	9.50
SD-TR3-D-B	MHP 703	10/18/88	8.20	27.80 E	16200.00	12.60	5280.00	500.00	0.10 U	9.70
SD-TR4-A-A	MHP 318	10/19/88	7.30	284.00 E	9640.00	50.80	5390.00	2350.00	0.61	11.30
SD-TR4-A-B	MHP 704	10/19/88	7.50	31.50 E	8620.00	15.90 S	2500.00	331.00	0.10 U	3.70
SD-TR4-A-B	MHP 319	10/19/88	5.30	2.00 E	11300.00	44.00	4940.00	762.00	0.49	9.90
SD-TR4-A-B	MHP 315	10/19/88	4.10	39.70 E	6950.00	14.30 S	2420.00	107.00	0.09 U	4.50

MILLITON SEDIMENT ANALYSIS

SAMPLE NO	TR NO	DATE	CO	CU	FE	FB	MG	MN	HG	NI
			DU	DU	FE	FB	MG	MN	HG	NI
			DU	DU	FE	FB	MG	MN	HG	NI
SD-TR4-AJ	TR4	11/09/88	8.70	4.60	27.60	1.60	50.60	1.80	0.20	15.70
SD-TR4-B-A	TR4	10/19/88	6.10	123.00	10600.00	24.40	5220.00	610.00	0.36	7.20
SD-TR4-B-B	TR4	10/19/88	4.10	42.20	7750.00	13.60	2430.00	133.00	0.08	3.90
SD-TR4-C-A	TR4	10/19/88	7.90	153.00	13600.00	36.20	6850.00	875.00	0.28	10.10
SD-TR4-C-B	TR4	10/19/88	6.70	98.90	10700.00	23.00	5100.00	543.00	0.14	7.00
SD-TR4-CK-A	TR4	10/19/88	7.90	143.00	13000.00	32.90	7040.00	924.00	0.42	9.10
SD-TR4-CK-B	TR4	10/19/88	6.70	119.00	11500.00	24.70	5550.00	617.00	0.18	8.80
SD-TR4-D-A	TR4	10/19/88	6.80	67.10	13700.00	39.30	6850.00	626.00	0.35	11.10
SD-TR4-D-B	TR4	10/19/88	5.10	97.80	9500.00	27.80	5150.00	448.00	0.28	8.70
SD-TR4-D1-A	TR4	10/20/88	6.30	36.10	14500.00	11.20	14300.00	407.00	0.09	9.30
SD-TR4-D1-B	TR4	10/20/88	6.20	37.50	13900.00	9.60	13100.00	424.00	0.11	9.60
SD-TR5-A-A	TR5	10/19/88	7.70	357.00	14200.00	55.60	6070.00	1530.00	0.66	13.40
SD-TR5-A-B	TR5	10/19/88	3.80	51.00	8350.00	16.30	3330.00	274.00	0.10	6.50
SD-TR5-A1-A	TR5	10/20/88	6.00	282.00	11500.00	49.20	5410.00	770.00	0.57	10.10
SD-TR5-A1-B	TR5	10/20/88	4.00	76.10	8040.00	20.30	3340.00	274.00	0.10	5.60
SD-TR5-B-A	TR5	10/19/88	6.40	363.00	14100.00	60.70	6250.00	466.00	0.80	10.50
SD-TR5-B-B	TR5	10/19/88	5.20	142.00	9750.00	28.50	4050.00	215.00	0.22	7.40
SD-TR5-B1-A	TR5	10/20/88	5.60	376.00	13200.00	60.00	5910.00	873.00	0.80	9.60
SD-TR5-B1-B	TR5	10/20/88	6.20	257.00	11500.00	46.80	4650.00	544.00	0.60	7.70
SD-TR5-C-A	TR5	10/19/88	6.40	151.00	11100.00	38.50	6000.00	652.00	0.22	11.20
SD-TR5-C-B	TR5	10/19/88	5.10	99.60	9170.00	24.30	4330.00	447.00	0.10	8.20
SD-TR5-C1-A	TR5	10/20/88	6.70	99.00	11700.00	37.40	5860.00	512.00	0.41	11.20
SD-TR5-C1-B	TR5	10/20/88	4.30	42.60	8540.00	19.50	3620.00	226.00	0.10	6.50
SD-TR5-D-A	TR5	10/19/88	5.40	42.80	14100.00	19.30	5580.00	353.00	0.11	11.10
SD-TR5-D-B	TR5	10/19/88	5.10	62.30	10100.00	12.10	4060.00	215.00	0.10	6.00
SD-TR5-A-A	TR5	10/20/88	7.10	237.00	13200.00	45.90	6480.00	1130.00	0.21	12.80
SD-TR5-A-B	TR5	10/20/88	2.70	38.20	6350.00	10.90	2250.00	197.00	0.10	4.10
SD-TR5-A1-A	TR5	10/20/88	6.40	328.00	12400.00	61.20	5350.00	750.00	0.69	11.20
SD-TR5-A1-B	TR5	10/20/88	4.30	82.00	8700.00	21.20	3360.00	258.00	0.19	5.40
SD-TR5-B-A	TR5	10/20/88	6.00	366.00	10400.00	50.50	5000.00	921.00	0.56	9.30
SD-TR5-B-B	TR5	10/20/88	3.30	54.80	6530.00	15.10	2400.00	171.00	0.09	4.90
SD-TR5-B1-A	TR5	10/20/88	5.00	132.00	7860.00	35.90	4810.00	480.00	0.23	7.40
SD-TR5-B1-B	TR5	10/20/88	4.50	54.90	7250.00	18.50	3120.00	193.00	0.10	5.60
SD-TR5-C-A	TR5	10/20/88	7.90	275.00	14300.00	58.10	6150.00	1100.00	0.52	12.60
SD-TR5-C-B	TR5	10/20/88	6.30	212.00	12100.00	40.60	4820.00	769.00	0.31	9.30
SD-TR5-C1-A	TR5	10/20/88	7.20	318.00	13600.00	57.30	6090.00	1150.00	0.28	11.50

05/07/89

MILLTOWN SEDIMENT ANALYSIS

SAMPLE NO	ITR NO	DATE	CO DO DURL	CU CU DURL	FE FE DURL	PB PB DURL	MB MB DURL	MN MN DURL	HB HB DURL	NI NI DURL
SD-TR6-T1-B	MHQ 721	10/20/88	6.00	191.00 *E	10500.00	43.70	4210.00	652.00	0.21	9.00
SD-TR6-CK-A	MHP 739	10/20/88	9.10	257.00 E	14600.00 E	57.50 W	6790.00	1160.00 E	0.54	12.30
SD-TR6-CK-E	MHQ 725	10/20/88	6.00	226.00 *E	11500.00	48.10 S	4730.00	789.00	0.29	9.30
SD-TR6-D-A	MHP 340	10/20/88	5.70	381.00 E	13500.00 E	45.90 W	6430.00	372.00 E	0.59	10.90
SD-TR6-D-B	MHQ 726	10/20/88	6.40	365.00 *E	13800.00	39.50	5940.00	354.00	0.50	10.50
SD-TR6-DJ	MHQ 284	11/07/88	8.70 U	4.60 U	22.60 U	1.60 U	50.60 U	1.80 U	0.20 U	15.70 U

HILLTOPP SEDIMENT ANALYSIS

SAMPLE NO	ITR NO	DATE	K K CORAL	SE SE CORAL	AS AS CORAL	NA NA CORAL	TH TH CORAL	VA VA CORAL	Z Z CORAL
SD-088-A	MHP 303	10/17/88	1840.00	0.80 W	1.40	177.00	0.29 U NW	21.40	775.00
SD-088-B	MHP 289	10/17/88	744.00	0.51 W	0.70 U	84.50	0.27 U NW	17.70	235.00
SD-088-C	MHP 302	10/17/88	1520.00	0.62	1.30	154.00	0.29 U NW	19.60	632.00
SD-088-D	MHP 288	10/17/88	760.00	0.65 W	0.72 U	83.00	0.28 U NW	13.80	255.00
SD-088-E-A	MHP 309	11/11/88	1870.00	0.76 W+	0.74 U	230.00	0.29 U NW	18.30	712.00 E
SD-TR1-A-A	MHP 304	10/18/88	1810.00	0.71 NW	0.74 U	182.00	0.28 U NW	18.40	761.00 E
SD-TR1-A-B	MHP 290	10/18/88	842.00	0.63 NS	0.78	102.00	0.28 U NW	15.10	294.00 E
SD-TR1-B-A	MHP 305	10/18/88	1940.00	0.78 NW	0.76 U	179.00	0.29 U NW	22.10	745.00 E
SD-TR1-B-B	MHP 291	10/18/88	1070.00	0.62 NW	0.73 U	195.00	0.28 U NW	13.90	386.00 E
SD-TR1-C-A	MHP 306	10/18/88	1770.00	0.54 NW	0.75 U	139.00	0.29 U NW	19.90	125.00 E
SD-TR1-C-B	MHP 292	10/18/88	1570.00	0.54 NW	0.74 U	84.10	0.28 U NW	18.20	54.50 E
SD-TR1-D-A	MHP 307	10/18/88	3700.00	0.53 NW	0.72 U	154.00	0.29 U NW	24.80	56.60 E
SD-TR1-D-B	MHP 293	10/18/88	2360.00	0.52 NW	0.71 U	95.40	0.27 U NW	17.70	39.50 E
SD-TR2-A-A	MHP 294	10/18/88	746.00	0.50 NW	0.71 U	84.80	0.27 U NW	13.20	231.00 E
SD-TR2-A-B	MHP 308	10/18/88	1910.00	1.20 W+	0.79 U	188.00	0.31 U NW	17.90	799.00 E
SD-TR2-B-B	MHP 295	10/18/88	652.00	0.43 NW	0.73 U	80.60	0.28 U NW	17.90	208.00 E
SD-TR2-C-A	MHP 310	10/18/88	2970.00	0.42 U W	0.72 U	242.00	0.31 NW	22.80	67.80 E
SD-TR2-C-B	MHP 296	10/18/88	1410.00	0.50 NW	0.71 U	106.00	0.28 U NW	19.20	558.00 E
SD-TR2-D-A	MHP 311	10/18/88	1400.00	0.62 NW	0.74 U	120.00	0.28 U NW	19.80	614.00 E
SD-TR2-D-B	MHP 297	10/18/88	1850.00	0.54 W+	0.70 U	157.00	0.27 U NW	18.50	44.20 E
SD-TR3-A-A	MHP 315	10/18/88	1880.00	0.27 U W	0.77 U	200.00	1.10 U NW	15.90	764.00 E
SD-TR3-A-B	MHP 701	10/18/88	725.00	0.26 U NW	0.73 U	95.80	0.22 U NW	8.90	250.00 E
SD-TR3-A1-A	MHP 312	10/18/88	1270.00	0.79 W	0.74 U	163.00	0.28 U NW	14.50	640.00 E
SD-TR3-A1-B	MHP 298	10/18/88	628.00	0.40 U W	0.73 U	104.00	0.27 U NW	14.40	193.00 E
SD-TR3-B-A	MHP 316	10/18/88	1890.00	0.27 U NW	1.40	182.00	1.10 U NW	16.40	1140.00 E
SD-TR3-B-B	MHP 702	10/18/88	1650.00	0.25 U NW	1.50	148.00	0.21 U NW	17.80	816.00 E
SD-TR3-B1-A	MHP 313	10/18/88	1460.00	1.30 NS	0.77 U	159.00	0.23 U NW	11.80	679.00 E
SD-TR3-B1-B	MHP 299	10/18/88	605.00	0.45 NW	0.70 U	98.80	0.26 U NW	10.80	185.00 E
SD-TR3-C-A	MHP 314	10/18/88	1460.00	0.26 U NW	0.76 U	118.00	0.22 U NW	17.50	1140.00 E
SD-TR3-C-B	MHP 300	10/18/88	1370.00	0.44 W	0.72 U	107.00	0.28 U NW	17.50	832.00 E
SD-TR3-D-B	MHP 317	10/18/88	2990.00	0.26 U NW	0.75 U	113.00	0.22 U NW	16.20	55.70 E
SD-TR4-A-A	MHP 703	10/18/88	2600.00	0.26 U NW	0.70 U	99.10	0.22 U NW	15.30	51.70 E
SD-TR4-A-B	MHP 318	10/17/88	1470.00	0.27 U NW	0.95	197.00	0.23 U NW	11.70	636.00 E
SD-TR4-A-B	MHP 704	10/17/88	636.00	0.25 U NW	0.73 U	80.50	0.21 U NW	9.60	176.00 E
SD-TR4-A1-A	MHP 319	10/19/88	1410.00	0.27 U NW	0.76 U	157.00	1.10 U W	15.30	706.00 E
SD-TR4-A1-B	MHP 705	10/19/88	667.00	0.26 U NW	0.73 U	89.50	0.22 U NW	12.40	238.00 E

MILLTOWN SEDIMENT ANALYSIS

SAMPLE NO	ITS NO	DATE	K K QUAL	SE SE QUAL	AG AS QUAL	NA NA QUAL	TH TH QUAL	VA VA QUAL	Z Z QUAL
SD-TR4-AJ	MHP 323	11/07/88	236.00 U	1.50 N	3.70 U H	181.00 U	1.40 U	2.80 U	11.70 U
SD-TR4-B-A	MHP 320	10/19/88	1100.00	0.26 U NH	0.73 U	87.30	0.22 U NH	14.40	500.00 E
SD-TR4-B-B	MHP 706	10/19/88	615.00	0.26 NH	0.72 U	77.00	0.22 U NH	16.20	228.00 E
SD-TR4-C-A	MHP 321	10/19/88	1500.00	0.26 U NH	0.71 U	116.00	0.22 U NH	20.10	676.00 E
SD-TR4-C-B	MHP 707	10/19/88	1110.00	0.25 U NH	0.71 U	91.90	0.21 U NH	15.70	470.00 E
SD-TR4-CK-A	MHP 322	10/19/88	1460.00	0.26 U NH	0.75 U	113.00	0.22 U NH	18.40	623.00 E
SD-TR4-CK-B	MHP 708	10/19/88	1160.00	0.25 U NH	0.71 U	94.40	0.21 U NH	16.30	508.00 E
SD-TR4-D-A	MHP 323	10/19/88	2660.00	0.28 U NH	0.77 U	171.00	0.23 U NH	19.70	324.00 E
SD-TR4-D-B	MHP 709	10/19/88	2040.00 #	0.55 NH/JSC	0.85 #	116.00 #	0.22 U#NH/R-S	11.30 #	186.00 #E /J-E
SD-TR4-D1-A	MHP 329	10/20/88	3040.00	1.40 U N	0.79 U	174.00	0.24 U NH	13.10	58.30 E
SD-TR4-D1-B	MHP 715	10/20/88	2660.00 #	0.45 NH/JSC	0.76 UH	165.00 #	0.23 U#NH/R-S	12.90 #	72.40 #E /J-E
SD-TR5-A-A	MHP 324	10/19/88	2030.00	0.27 U NH	1.90	264.00	0.25 NH	19.60	674.00 E
SD-TR5-A-B	MHP 710	10/19/88	650.00	0.26 U NH	0.74 U	83.20	0.22 U H	15.30	206.00 E
SD-TR5-A1-A	MHP 330	10/20/88	1650.00	0.27 U NH	1.70	165.00	0.23 U H	14.60	572.00 E
SD-TR5-A1-B	MHP 716	10/20/88	838.00	0.60 NH	0.72 U	115.00	0.28 U H	13.30	180.00
SD-TR5-B-A	MHP 325	10/19/88	1910.00	0.23 U NH	1.60	184.00	0.24 U H	18.90	725.00 E
SD-TR5-B-B	MHP 711	10/19/88	1170.00	0.26 U NH	0.73 U	121.00	0.22 U H	11.70	377.00 E
SD-TR5-B1-A	MHP 331	10/20/88	1850.00	0.30 U N	1.90	190.00	0.30 H	15.70	742.00 E
SD-TR5-B1-B	MHP 717	10/20/88	1440.00	1.00 N	0.82 U	129.00	0.33 U H	12.90	518.00
SD-TR5-C-A	MHP 326	10/19/88	1060.00	0.26 U NH	1.60	143.00	0.22 U H	16.90	486.00 E
SD-TR5-C-B	MHP 712	10/19/88	927.00	0.26 U NH	0.75 U	87.40	0.22 U H	12.90	359.00 E
SD-TR5-C1-A	MHP 332	10/20/88	1480.00	0.26 U NH	1.30	128.00	0.22 U H	18.60	203.00 E
SD-TR5-C1-B	MHP 718	10/20/88	920.00	0.58 NH	0.74 U	71.30	0.28 U H	12.70	78.80
SD-TR5-D-A	MHP 327	10/19/88	3490.00	0.25 U NH	0.75 U	88.40	0.22 U NH	17.50	92.20 E
SD-TR5-D-B	MHP 713	10/19/88	2190.00	0.55 NH	0.74 U	72.60	0.42 NH	13.20	52.20
SD-TR5-E-A	MHP 336	10/20/88	1530.00	0.27 U NH	0.76 U	159.00	0.23 U H	20.80	671.00 E
SD-TR5-E-B	MHP 722	10/20/88	574.00	0.40 U	0.71 U	144.00	0.27 U H	10.10	172.00
SD-TR5-E1-A	MHP 333	10/20/88	1860.00	0.26 U NH	2.80	194.00	0.24 H	18.50	678.00 E
SD-TR5-E1-B	MHP 719	10/20/88	839.00	0.43 NH	0.74 U	95.10	0.27 U H	14.10	238.00
SD-TR5-F-A	MHP 337	10/20/88	1910.00	0.40 NH	1.10	177.00	0.22 U H	15.40	777.00 E
SD-TR5-F-B	MHP 723	10/20/88	652.00	0.42 U H	0.74 U	77.70	0.28 U H	10.50	220.00
SD-TR5-F1-A	MHP 334	10/20/88	919.00	0.27 U NH	0.75 U	122.00	0.22 U H	11.50	428.00 E
SD-TR5-F1-B	MHP 720	10/20/88	896.00	0.64 NH	0.75 U	79.40	0.38 U H	9.90	272.00
SD-TR5-G-A	MHP 336	10/20/88	1520.00	0.26 U NH	1.50	121.00	0.22 U H	20.00	1110.00 E
SD-TR5-G-B	MHP 724	10/20/88	1290.00	0.41 U H	0.71 U	126.00	0.27 U H	15.50	766.00
SD-TR5-G1-A	MHP 335	10/20/88	1470.00	0.26 U NH	0.96	108.00	0.22 U H	17.10	1190.00 E

HILL TOWN SEDIMENT ANALYSIS

SAMPLE NO	TR NO	DATE	K K DUAL	SE SE DUAL	AS AS DUAL	MS MS DUAL	TH TH DUAL	VA VA DUAL	Z Z DUAL
SD-TR6-C1-B	WHD 721	10/20/88	1170.00	0.43 NW	1.30	88.80	0.28 U N	14.40	694.00
SD-TR6-CK-A	WHP 339	10/20/88	1570.00	0.25 U NW	0.75 U	120.00	0.22 U N	18.70	1230.00 E
SD-TR6-CK-B	WHD 725	10/20/88	1230.00	0.41 U 4+	1.10	171.00	0.27 U N	15.00	845.00
SD-TR6-V-A	WHP 340	10/20/88	1820.00	0.25 U NW	1.00	136.30	0.22 U N	17.90	200.00 E
SD-TR6-E-E	WHD 726	10/20/88	1540.00	0.42 U NS	2.00	150.00	0.28 U N	18.30	175.00
SD-TR6-DJ	WHD 294	11/09/88	236.00 U	1.30 U N	3.70 U N	161.00 U	1.40 U	2.90 U	11.70 U

MILLTOWN PH & EC ----- TASK 2

DATE	SAMPLE NO	pH	EC GRAMS USED	COMMENTS
/ /	SD-098	7.80	130	35
/ /	SD-098	7.33	115	60
/ /	SD-TR1-A	7.30	172	50
/ /	SD-TR1-B	7.00	370	45
/ /	SD-TR1-C	7.60	107	70
/ /	SD-TR1-D	7.32	130	80
/ /	SD-TR2-A	7.45	212	95
/ /	SD-TR2-B	7.25	160	90
/ /	SD-TR2-C	7.61	110	100
/ /	SD-TR2-D	8.10	195	100
/ /	SD-TR3-A	7.20	144	85
/ /	SD-TR3-B1	7.30	70	100
/ /	SD-TR3-B	7.40	325	40
/ /	SD-TR3-B1	6.85	100	100
/ /	SD-TR3-C	7.40	125	100
/ /	SD-TR3-D	6.80	75	100
/ /	SD-TR4-A	7.60	105	100
/ /	SD-TR4-A1	7.32	125	100
/ /	SD-TR4-B	7.15	98	100
/ /	SD-TR4-C	7.60	100	100
/ /	SD-TR4-OK	7.80	120	100
/ /	SD-TR4-D	7.80	270	100
/ /	SD-TR4-D1	7.70	185	100
/ /	SD-TR5-A	7.85	95	100
/ /	SD-TR5-B1	7.50	310	100
/ /	SD-TR5-B	7.45	195	45
/ /	SD-TR5-B1	7.10	265	15
/ /	SD-TR5-C	7.65	95	100
/ /	SD-TR5-D1	7.95	90	100
/ /	SD-TR5-D	7.42	130	100
/ /	SD-TR6-A	7.25	42	100
/ /	SD-TR6-A1	7.42	370	80
/ /	SD-TR6-B	7.37	150	100
10/20/88	SD-TR5-B1-A	7.70	95	100
/ /	SD-TR6-C	7.80	52	100
/ /	SD-TR6-C1	7.70	55	100

Used 100 mls. of DI water
Very green supernatant

Very green supernatant

Used 100 mls. of DI water
Used 100 mls. of DI water

05/09/89

MILLTOWN PH & EC ---- TASK 2

DATE	SAMPLE NO	PH	EC	GRAMS USED	COMMENTS
/ /	50-TR6-CK	7.50	95	100	
/ /	50-TR6-D	7.73	165	100	
10/26/88	50-001	7.85	700	100	
10/26/88	50-002	8.07	470	100	
10/26/88	50-003	8.00	165	100	
10/26/88	50-004	5.75	100	100	
10/26/88	50-005	6.55	140	100	
10/26/88	50-006	5.60	325	100	
10/26/88	50-007	6.80	150	100	
10/26/88	50-007-K	6.96	155	100	
10/26/88	50-008	8.00	240	100	
10/26/88	50-009	8.00	275	100	
10/26/88	50-010	6.45	110	100	
10/26/88	50-011	5.48	80	100	
10/26/88	50-012	5.05	105	100	
10/26/88	50-013	5.34	185	100	
10/26/88	50-014	6.65	195	100	
10/26/88	50-015	6.80	122	100	
10/26/88	50-016	6.70	85	100	
10/26/88	50-017	7.25	145	100	
10/26/88	50-018	6.33	65	100	
10/27/88	50-019	6.23	75	100	
10/27/88	50-020	6.35	85	100	
10/27/88	50-021	6.40	65	100	
10/27/88	50-022-A	5.99	105	100	
10/27/88	50-022-B	7.64	130	100	
10/27/88	50-023-A	6.18	110	100	
10/27/88	50-023-B	6.16	55	100	
10/27/88	50-024-A	6.10	110	100	
10/27/88	50-024-B	6.45	100	100	
10/27/88	50-025	7.20	100	100	
10/27/88	50-025-K	7.35	100	100	
10/27/88	50-026	6.43	50	100	
10/27/88	50-027	6.59	80	100	
10/27/88	50-028	7.00	110	100	
10/27/88	50-029	7.40	150	100	

MILTON PH & EC ---- TASK 2

DATE SAMPLE NO PH EC GRAMS USED COMMENTS

10/27/88 80-030 7.10 85 100

APPENDIX 5.2.3

GROUND WATER RAW DATA

GROUNDWATER ANALYSIS ---- TASK 2

SITE NAME	ITR NO	SAMPLE NO	DATE	AL AL QUAL	SB SB QUAL	AS AS QUAL	BA BA QUAL	BE BE QUAL	CD CD QUAL	CA CA QUAL
A1	MHJ 266	GW-A1-001	11/02/88	17.40 U#	22.10 U#	2.30 #	118.00 #	0.90 U#	3.10 U#	42400.00 #
A2	MHJ 269	GW-A2-001	11/02/88	24.90 #	22.10 U#	7.50 #	172.00 #	0.90 U#	3.10 U#*	43700.00 #
A3	MHJ 267	GW-A3-001	11/02/88	17.40 U#	22.10 U#	6.30 #	180.00 #	0.90 U#	3.10 U#*	45200.00 #
A4	MHJ 264	GW-A4-001	11/01/88	17.40 U#	22.10 U#	3.80 #	181.00 #	0.90 U#	3.10 U#*	40400.00 #
C21	MHJ 285	GW-C21-001	11/01/88	17.40 U	22.10 U	2.10	183.00	0.90 U	3.10 U	35900.00
C24	MHJ 259	GW-C24-001	10/31/88	22.20 #	22.10 U#	2.50 #	215.00 #	0.90 U#	10.00 #**	29600.00 #
	MHJ 260	GW-C24K-001	10/31/88	18.10 #	22.10 U#	2.70 #	215.00 #	0.90 U#	3.10 U#*	30900.00 #
	MHJ 261	GW-C24M-001	10/31/88	17.40 U#	22.10 U#	1.90 U#	3.00 U#	0.90 U#	3.10 U#*	38.00 U#
C28	MHJ 257	GW-C28-001	10/31/88	27.90 #	22.10 U#	3.40 #	216.00 #	1.10 #	3.10 U#*	31200.00 #
	MHJ 258	GW-C28N-001	10/31/88	23.20 #	22.10 U#	1.90 U#	3.00 U#	0.90 U#	3.10 U#*	156.00 #
C28P	MHJ 300	GW-C28P-001	10/31/88	447.00	22.10 U	102.00 #	3.00 U	90.10	21.70	70.40
C8	MHJ 265	GW-C8-001	11/02/88	17.40 U#	22.10 U#	2.70 #	173.00 #	0.90 U#	3.10 U#*	39700.00 #
DW13	MHJ 271	GW-DW13-001	11/02/88	29.50 #	22.10 U#	4.10 #	181.00 #	0.90 U#	3.10 U#*	41900.00 #
DW7	MHJ 263	GW-DW7-001	11/01/88	18.60 #	22.10 U#	2.50 #	209.00 #	0.90 U#	3.10 U#*	32000.00 #
HB	MHJ 270	GW-HB-001	11/02/88	17.40 U#	22.10 U#	5.60 #	165.00 #	0.90 U#	3.10 U#*	46400.00 #
HLA1	MHJ 274	GW-HLA1-001	11/03/88	23.20 #	22.10 U#	173.00 #	372.00 #	0.90 U#	3.10 U#*	48300.00 #
HL22	MHJ 275	GW-HLA2-001	11/04/88	18.60 #	22.10 U#	101.00 #	332.00 #	0.90 U#	3.10 U#*	60500.00 #
M16	MHJ 273	GW-M16-001	11/03/88	17.40 U#	22.10 U#	2.90 #	154.00 #	0.90 U#	3.10 U#*	29700.00 #
M17	MHJ 276	GW-M17-001	11/04/88	17.40 U	22.10 U	9.70	230.00	0.90 U	3.10 U	32100.00 U
MT12	MHJ 262	GW-MT19-001	11/01/88	25.30 #	22.10 U#	2.20 #	234.00 #	0.90 U#	3.10 U#*	31300.00 #
OH	MHJ 268	GW-OH-001	11/02/88	17.40 U#	22.10 U#	7.40 #	172.00 #	0.90 U#	3.10 U#*	42700.00 #
LP	MHJ 278	GW-LP-001	11/04/88	250.00	22.10 U	9.80	190.00	0.90 U	3.10 U	26300.00
	MHJ 286	GW-LP1-001	11/04/88	17.40 U	22.10 U	1.30 U	14.10	0.90 U	3.10 U	181.00
	MHJ 287	GW-LP2-001	11/04/88	250.00	22.10 U	9.60	193.00	0.90 U	3.10 U	25800.00

GROUNDWATER ANALYSIS ----- TABLE 2

SITE NAME	ITR NO	SAMPLE NO	DATE	CR CR QUAL	CO CO QUAL	CU CU QUAL	FE FE QUAL	MG MG QUAL	MIN MIN QUAL
A1	MHJ 266	GW-A1-001	11/02/88	8.00 # /U30	8.70 U#	4.60 U#	22.60 U#	10200.00 #	3.20 #
A2	MHJ 267	GW-A2-001	11/02/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 #	11500.00 #	3.50 #
A3	MHJ 267	GW-A3-001	11/02/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	11500.00 #	1.80 U# /U30
A4	MHJ 264	GW-A4-001	11/01/88	8.00 U# /U30	8.70 U#	0.20 U#	22.60 U#	11200.00 #	1.80 U# /U30
C21	MHJ 265	GW-C21-001	11/01/88	8.00 U	8.70 U	4.60 U	22.60 U	10600.00	22.70
C2A	MHJ 259	GW-C2A-001	10/31/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	9940.00 #	1.80 U# /U30
	MHJ 250	GW-C2A-001	10/31/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	10000.00 #	1.80 U# /U30
	MHJ 261	GW-C2A-001	10/31/88	8.00 U# /U30	8.70 U#	36.70 #	22.60 U#	50.60 U#	3.20 #
	MHJ 257	GW-C2B-001	10/31/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	10200.00 U#	1.90 #
	MHJ 258	GW-C2B-001	10/31/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	50.60 U#	2.60 #
C2EP	MHJ 300	GW-C2EP-001	10/31/88	84.70	85.00	24.10	99.40	50.60 U	87.60
C3	MHJ 265	GW-C3-001	11/02/88	8.00 U# /U30	8.70 U#	152.00 #	22.60 U#	11000.00 #	4.20 #
EW13	MHJ 271	GW-DW13-001	11/02/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 #	11400.00 #	4.20 #
EW7	MHJ 263	GW-DW7-001	11/01/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	9830.00 #	1.80 U# /U30
HB	MHJ 270	GW-HB-001	11/02/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	11700.00 #	6.10 #
HLA1	MHJ 274	GW-HLA1-001	11/03/88	8.00 U# /U30	8.70 U#	4.60 U#	1650.00 #	12600.00 #	1760.00 #
HLA2	MHJ 275	GW-HLA2-001	11/04/88	8.00 U# /U30	8.70 U#	4.60 U#	335.00 #	13300.00 #	2830.00 #
M15	MHJ 273	GW-M15-001	11/03/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	10500.00 #	3.20 #
M17	MHJ 276	GW-M17-001	11/04/88	8.00 U	8.70 U	4.60 U	228.00	9330.00	241.00
MT19	MHJ 262	GW-MT19-001	11/01/88	8.00 U# /U30	8.70 U#	4.60 U#	22.60 U#	10300.00 #	1.80 U# /U30
OH	MHJ 268	GW-OH-001	11/02/88	8.00 U# /U30	8.70 U#	4.60 U#	34.10 #	11400.00 #	1.80 U# /U30
LP	MHJ 278	GW-LP-001	11/04/88	8.00 U	8.70 U	4.60 U	1480.00	7920.00	664.00
	MHJ 266	GW-LP3-001	11/04/88	8.00 U	8.70 U	4.60 U	22.60 U	50.60 U	1.80 U
	MHJ 297	GW-LP4-001	11/04/88	8.00 U	8.70 U	10.60	1470.00	7750.00	649.00

GROUNDWATER ANALYSIS ---- TASK 2

SITE NAME	ITR NO	SAMPLE NO	DATE	HG HG QUAL	MI MI QUAL	K K QUAL	SE SE QUAL	AG AG QUAL	NA NA QUAL	TH TH QUAL
A1	MHJ 265	GW-A1-001	11/02/88	0.20 U#	15.70 U#	1290.00 #	2.10 U#	3.70 U#	4090.00 #	1.10 U#
	MHJ 267	GW-A2-001	11/02/88	0.20 U#	15.70 U#	1370.00 #	2.10 U#	3.70 U#	5100.00 #	1.10 U#
	MHJ 267	GW-A3-001	11/02/88	0.20 U#	15.70 U#	1430.00 #	2.10 U#	3.70 U#	5390.00 #	1.10 U#
	MHJ 264	GW-A4-001	11/01/88	0.20 U#	15.70 U#	1320.00 #	2.30 #	3.70 U#	5410.00 #	1.10 U#
C21	MHJ 265	GW-C21-001	11/01/88	0.20 U	15.70 U	1210.00	1.30 U N	3.70 U N	4840.00	1.40 U
C2A	MHJ 259	GW-C2A-001	10/31/88	0.20 U#	15.70 U#	1120.00 #	2.10 U#	3.70 U#	3790.00 #	1.10 U#
	MHJ 260	GW-C2A-001	10/31/88	0.20 U#	15.70 U#	1100.00 #	2.10 U#	3.70 U#	3800.00 #	1.10 U#
	MHJ 261	GW-C2A-001	10/31/88	0.30 #	15.70 U#	236.00 U#	2.10 U#	3.70 U#	181.00 U#	1.10 U#
	MHJ 257	GW-C2B-001	10/31/88	0.20 U#	15.70 U#	1130.00 #	2.10 U#	3.70 U#	3820.00 #	1.10 U#
C2B	MHJ 258	GW-C2B-001	10/31/88	0.20 U#	15.70 U#	235.00 U#	2.10 U#	3.70 U#	181.00 U#	1.10 U#
	MHJ 300	GW-C2B-001	10/31/88	7.20	86.00	236.00 U	18.70 +	3.70 U	269.00	1.40 U
C2P	MHJ 265	GW-C2P-001	11/02/88	0.20 U#	15.70 U#	1260.00 #	2.10 U#	3.70 U#	5380.00 #	1.10 U#
C3	MHJ 271	GW-C3-001	11/02/88	0.20 U#	15.70 U#	1420.00 #	2.40 #	3.70 U#	5490.00 #	1.10 U#
EW13	MHJ 263	GW-EW13-001	11/01/88	0.20 U#	15.70 U#	1080.00 #	2.10 U#	3.70 U#	4200.00 #	1.10 U#
EW5	MHJ 270	GW-EW5-001	11/02/88	0.20 U#	15.70 U#	1130.00 #	2.10 U#	3.70 U#	3690.00 #	1.10 U#
HE	MHJ 274	GW-HE-001	11/03/88	0.20 U#	15.70 U#	1980.00 #	2.10 U#	3.70 U#	5130.00 #	1.10 U#
HLA1	MHJ 275	GW-HLA1-001	11/04/88	0.20 U#	15.70 U#	2320.00 #	2.10 U#	3.70 U#	11500.00 #	1.10 U#
HLA2	MHJ 273	GW-HLA2-001	11/03/88	0.20 U#	15.70 U#	765.00 #	2.10 U#	3.70 U#	2620.00 #	1.10 U#
HL6	MHJ 276	GW-HL6-001	11/04/88	0.20 U	15.70 U	934.00	1.90 N	3.70 U N	3390.00	1.40 U
HL7	MHJ 262	GW-HL7-001	11/01/88	0.20 U#	15.70 U#	1090.00 #	2.10 U#	3.70 U#	3810.00 #	1.10 U#
HT15	MHJ 268	GW-HT15-001	11/02/88	0.20 U#	15.70 U#	1750.00 #	2.10 U#	3.70 U#	5040.00 #	1.10 U#
OH	MHJ 273	SW-LF-001	11/04/88	0.20 U	15.70 U	12700.00	2.10 #	3.70 U N	29400.00	1.40 U
LP	MHJ 286	SW-LFJ-001	11/04/88	0.20 U	15.70 U	236.00 U	1.30 U N	3.70 U N	454.00	1.40 U
	MHJ 287	SW-LFK-001	11/04/88	0.20 U	15.70 U	12500.00	1.30 U N	3.70 U N	28500.00	1.40 U

GROUNDWATER ANALYSIS ---- TASK 2

SITE NAME	TR NO	SAMPLE NO	DATE	VA	VA DUPL	ZK	ZK DUPL
A1	NUJ 266	GW-A1-001	11/02/88	2.80 U#		15.20 #	
A2	NUJ 267	GW-A2-001	11/02/88	2.80 U#		11.70 U#	
A3	NUJ 267	GW-A3-001	11/02/88	2.80 U#		11.70 U#	
A4	NUJ 264	GW-A4-001	11/01/88	2.80 U#		11.70 U#	
C21	NUJ 285	GW-C21-001	11/01/88	2.80 U		11.70 U	
C24	NUJ 259	GW-C24-001	10/31/88	2.80 U#		11.70 U#	
	NUJ 260	GW-C24K-001	10/31/88	2.80 U#		11.70 U#	
	NUJ 261	GW-C24K-001	10/31/88	2.80 U#		57.50 #	
C2F	NUJ 257	GW-C2F-001	10/31/88	2.80 U#		11.70 U#	
	NUJ 258	GW-C2F4-001	10/31/88	2.80 U#		11.70 U#	
C2EP	NUJ 300	GW-C2EP-001	10/31/88	220.00		99.50	
C8	NUJ 265	GW-C8-001	11/02/88	2.80 U#		81.51 #	
DN13	NUJ 271	GW-DN13-001	11/02/88	2.80 U#		11.70 U#	
DN7	NUJ 263	GW-DN7-001	11/01/88	2.80 U#		22.70 #	
HN	NUJ 270	GW-HN-001	11/02/88	2.80 U#		56.00 #	
HLA1	NUJ 274	GW-HLA1-001	11/03/88	2.80 U#		11.70 U#	
HLA2	NUJ 275	GW-HLA2-001	11/04/88	2.80 U#		11.70 U#	
M16	NUJ 273	GW-M16-001	11/03/88	2.80 U#		135.00 #	
M17	NUJ 276	GW-M17-001	11/04/88	2.80 U		11.70 U	
MT19	NUJ 262	GW-MT19-001	11/01/88	2.80 U#		174.00 #	
OH	NUJ 268	GW-OH-001	11/02/88	2.80 U#		40.10 #	
LP	NUJ 278	SW-LP-001	11/04/88	2.80 U		124.00	
	NUJ 286	SW-LP3-001	11/04/88	2.80 U		11.70 U	
	NUJ 287	SW-LPK-001	11/04/88	2.80 U		124.00	

SEWELLVILLE TOWNSHIP

[illegible]

SEMIVOLATILE ORGANICS ANALYSIS

SITE NAME	SAMPLE NO	IFT NO	DATE	CHLORO 4	CHL	DUAL	METHYLENE	NET	DUAL	HEPTACHLOR	HEX	DUAL	TR12	4	6	TR1	DUAL	TR12	4	5	TR12	DUAL	CHLOROP	CH	DUAL	NITROBIL	NI	DUAL	DIMETHYLPH	DIM	DUAL	
C2BP	EW-C2BP-001	HH 627	11/09/88	36.00	#	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	45.00	#	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	3.00	#J	/J
C2E	EW-C2E-001	HH 001	11/28/88	10.00	UH	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	10.00	UH	
C2A	EW-C2A-001	HH 003	11/29/88	10.00	UH	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	2.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	10.00	UH	
	EW-C2AK-001	HH 004	11/29/88	10.00	UH	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	10.00	UH	
	EW-C2AM-001	HH 005	11/29/88	10.00	UH	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	10.00	UH	
	EW-C2EN-001	HH 002	11/29/88	10.00	UH	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	10.00	UH	
NT 19	EW-MT19-001	HH 006	11/29/88	10.00	UH	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	10.00	UH	
LP	EW-LP-001	HH 007	11/29/88	20.00	UH	20.00	UH	20.00	UH	20.00	UH	20.00	UH	100.00	UH	20.00	UH	20.00	UH	100.00	UH	20.00	UH	20.00	UH	100.00	UH	100.00	UH	20.00	UH	
	EW-LP3-001	HH 009	11/30/88	10.00	UH	10.00	UH	10.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	10.00	UH	10.00	UH	50.00	UH	50.00	UH	10.00	UH	
	EW-LPK-001	HH 008	11/30/88	20.00	UH	20.00	UH	20.00	UH	20.00	UH	20.00	UH	100.00	UH	20.00	UH	20.00	UH	100.00	UH	20.00	UH	20.00	UH	100.00	UH	100.00	UH	20.00	UH	

SEMIVOLATILE ORGANICS ANALYSIS

SITE NAME	SAMPLE NO	IRT NO	DATE	ACEMPTHY	ACE_GRA	DINITRO2_6	DINI_GRA
CZP	GW-CZP-001	HG 627	11/09/88	10.00	U#	10.00	U#
	GW-CZP-001	HH 001	11/28/88	10.00	U#	10.00	U#
	GW-CZP-001	HH 003	11/29/88	10.00	U#	10.00	U#
	GW-CZP-001	HH 004	11/29/88	10.00	U#	10.00	U#
	GW-CZP-001	HH 005	11/29/88	10.00	U#	10.00	U#
	GW-CZP-001	HH 002	11/29/88	10.00	U#	10.00	U#
WT 19	GW-WT19-001	HH 006	11/29/88	10.00	U#	10.00	U#
	SW-LP-001	HH 007	11/29/88	20.00	U#	20.00	U#
	SW-LP-001	HH 009	11/30/88	10.00	U#	10.00	U#
	SW-LP-001	HH 008	11/30/88	20.00	U#	20.00	U#

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q	
** EPA SAMPLE NO. HG 627					
123-92-2	1-BUTANOL, 3-METHYL-, ACETAT	7.10	430.00	J	/JN
	CONDENSATION PRODUCT	8.67	110.00	JA	/UJB
	SOLVENT IMPURITY	11.50	30.00	J	/JN
** EPA SAMPLE NO. HH 001	NONE DETECTED	0.00	0.00		
** EPA SAMPLE NO. HH 002	NONE DETECTED	0.00	0.00		
** EPA SAMPLE NO. HH 003	NONE DETECTED	0.00	0.00		
** EPA SAMPLE NO. HH 004	NONE DETECTED	0.00	0.00		
** EPA SAMPLE NO. HH 005	NONE DETECTED	0.00	0.00		
** EPA SAMPLE NO. HH 006	NONE DETECTED	0.00	0.00		
** EPA SAMPLE NO. HH 007					
501-52-0	BENZENEPROPANOIC ACID	20.37	2200.00	J	/JN
	UNKNOWN ACID	7.95	7600.00	J	/JN
	UNKNOWN ACID	10.47	1200.00	J	/JN
	UNKNOWN	23.97	530.00	J	/JN
90-29-5	CYCLOHEXANECARBOXYLIC ACID	15.88	440.00	J	/JN
	UNKNOWN	23.37	370.00	J	/JN
	UNKNOWN	22.28	370.00	J	/JN
	UNKNOWN	31.07	300.00	J	/JN
0-00-0	BENZENEPROPANOL, 4-HYDROXY-	24.18	360.00	J	/JN
	UNKNOWN	38.02	300.00	J	/JN
	UNKNOWN HYDROCARBON	35.47	290.00	J	/JN
	UNKNOWN	22.75	290.00	J	/JN
	UNKNOWN ACID	9.38	650.00	J	/JN
	UNKNOWN	21.53	260.00	J	/JN
	UNKNOWN ACID	9.72	380.00	J	/JN
	UNKNOWN ACID	11.52	40.00	J	/JN
646-07-1	PENTANOIC ACID, 4-METHYL-	11.78	80.00	J	/JN
	UNKNOWN ACID	12.48	210.00	J	/JN
** EPA SAMPLE NO. HH 008					
501-52-0	BENZENEPROPANOIC ACID	20.37	2400.00	J	/JN
	UNKNOWN ACID	8.65	9600.00	J	/JN
	UNKNOWN	23.97	900.00	J	/JN
	UNKNOWN	32.50	820.00	J	/JN
	UNKNOWN ACID	10.50	1600.00	J	/JN
	UNKNOWN	34.72	80.00	J	/JN

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CAS NUMBER	COMPOUND NAME	RT EST.	CONC.	Q
	UNKNOWN	31.07	80.00 J	/JN
98-89-5	CYCLOHEXANECARBOXYLIC ACID	15.92	440.00 J	/JN
0-00-0	BENZENEPROPANOL, 4-HYDROXY-	24.18	480.00 J	/JN
	UNKNOWN ACID	9.45	760.00 J	/JN
	UNKNOWN HYDROCARBON	35.47	80.00 J	/JN
646-07-1	PENTANOIC ACID, 4-METHYL-	11.82	720.00 J	/JN
	UNKNOWN	25.07	300.00 J	/JN
	UNKNOWN	21.53	300.00 J	/JN
2451-01-6	CIS-TERPIN HYDRATE	19.75	200.00 J	/JN
	UNKNOWN ACID	9.73	440.00 J	/JN
	UNKNOWN ACID	11.57	180.00 J	/JN
	UNKNOWN ACID	12.52	240.00 J	/JN
** EPA SAMPLE NO. HH 009				
	PHENOL, 2,6-BIS(1,1-DIMETHYL	23.43	14.00 J	/JN

REPORT FINDINGS

[illegible]

PESTICIDE REPORT

SITE NAME	SAMPLE NO	ITA NO	DATE	ENDRINMET	ALPHAHCYCLER AL	GAMMAHCYCLER	TOXAPHENE	AROCCL	AROCLO	AROC	AROC	AROC
C2A	SW-C2A-001	HH 003	10/31/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2A-001	HH 004	10/31/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2A-001	HH 005	10/31/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2A-001	HH 001	10/31/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2A-001	HH 002	10/31/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
C2B	SW-C2B-001	HG 627	10/31/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2B-001	HH 006	11/01/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2B-001	HH 007	11/04/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2B-001	HH 009	11/04/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#
	SW-C2B-001	HH 008	11/04/88	0.10 U#	0.50 U#	0.50 U#	1.00 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#	0.50 U#

PESTICIDE REPORT

SITE NAME	SAMPLE NO	ITR NO	DATE	ARO A QUAL	AR AGR QUAL	A QUAL
CZA	EW-CZA-001	HH 003	10/31/88	0.50 U#	1.00 U#	1.00 U#
	EW-CZA-001	HH 004	10/31/88	0.50 U#	1.00 U#	1.00 U#
	EW-CZA-001	HH 005	10/31/88	0.50 U#	1.00 U#	1.00 U#
	EW-CZA-001	HH 001	10/31/88	0.50 U#	1.00 U#	1.00 U#
	EW-CZA-001	HH 002	10/31/88	0.50 U#	1.00 U#	1.00 U#
CZB	EW-CZB-001	H5 627	10/31/88	0.50 U#	1.00 U#	1.00 U#
	EW-CZB-001	HH 006	11/01/88	0.50 U#	1.00 U#	1.00 U#
CZP	EW-CZP-001	HH 007	11/04/88	0.50 U#	1.00 U#	1.00 U#
	EW-LP-001	HH 009	11/04/88	0.50 U#	1.00 U#	1.00 U#
	EW-LP-001	HH 008	11/04/88	0.50 U#	1.00 U#	1.00 U#

VOLATILE ORGANICS ANALYSIS

SAMPLE NO	QTR NO	DATE	CHLOROMETH C DUAL	BROMOMETH B DUAL	VINYLCHL V DUAL	CHLOROPETH CH DUAL	METH CHLOR METH DUAL	ACETONE AC DUAL	CARS DISC CA DUAL	DIETHENE DI DUAL	DIEHTANE DIE DUAL
EW-C2A-001	HH 003	10/31/88	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	77.00 #B /UJEC	95.00 # /JEC	5.00 U#	5.00 U#	5.00 U#
EW-C2AK-001	HH 004	10/31/88	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	100.00 #B /UJEC	33.00 #B	5.00 U#	5.00 U#	5.00 U#
EW-C2AM-001	HH 005	10/31/88	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	85.00 #B /UJEC	110.00 #B /JEC	5.00 U#	5.00 U#	5.00 U#
EW-C2B-001	HH 001	10/31/88	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	86.00 # /UJEC	140.00 # /JEC	5.00 U#	5.00 U#	5.00 U#
EW-C2BW-001	HH 002	10/31/88	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	83.00 # /UJEC	160.00 # /JEC	5.00 U#	5.00 U#	5.00 U#
EW-C2BP-001	HS 627	10/31/88	10.00 U# /UJC	10.00 U# /UJC	10.00 U#	10.00 U#	73.00 #B /UJEC	30.00 #B	5.00 U#	5.00 U#	19.00 #
EW-MT19-001	HH 006	11/01/88	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	78.00 #B /UJEC	33.00 #B	5.00 U#	5.00 U#	5.00 U#
EW-LP-001	HH 007	11/04/88	100.00 U# /UJC	100.00 U# /UJC	100.00 U#	100.00 U#	780.00 #B /UJEC	320.00 #B	50.00 U#	50.00 U#	50.00 U#
EW-LP3-001	HH 009	11/04/88	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	61.00 #B /UJEC	120.00 #B /JEC	5.00 U#	5.00 U#	5.00 U#
EW-LPW-001	HH 008	11/04/88	100.00 U# /UJC	100.00 U# /UJC	100.00 U#	100.00 U#	820.00 #B /UJEC	240.00 #B	50.00 U#	50.00 U#	50.00 U#
EW-LPW-001	HH 010	/ /	10.00 U# /UJC	10.00 U#	10.00 U#	10.00 U#	140.00 #B /JEC	130.00 #B/JEC	5.00 U#	5.00 U#	5.00 U#

VOLATILE ORGANICS ANALYSIS

SAMPLE NO	QTR NO	DATE	DIETHYLENE GLYCOL DICHL 2	DICH GLYCOL BUTADIENE BUT GLYCOL	ICE TCE GLYCOL CARBOTETRA CARB GLYCOL VINYLACET VIN GLYCOL BROMODICHL BROMO GLYCOL DICHLOROP DICH GLYCOL	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-C2A-001	HH 003	10/31/88	5.00 U#	5.00 U#	10.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-C2AK-001	HH 004	10/31/88	5.00 U#	5.00 U#	10.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-C2AM-001	HH 005	10/31/88	5.00 U#	5.00 U#	17.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-C2E-001	HH 001	10/31/88	5.00 U#	5.00 U#	10.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-C2EN-001	HH 002	10/31/88	5.00 U#	5.00 U#	14.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-C2EP-001	HS 527	10/31/88	5.00 U#	5.00 U#	11.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	18.00	5.00 U#
GW-MT19-001	HH 006	11/01/88	5.00 U#	5.00 U#	10.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-LP-001	HH 007	11/04/88	50.00 U#	50.00 U#	110.00	50.00 U#	50.00 U#	100.00 U#	50.00 U#	50.00 U#	50.00 U#
GW-LPJ-001	HH 009	11/04/88	5.00 U#	5.00 U#	19.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#
GW-LPY-001	HH 008	11/04/88	50.00 U#	50.00 U#	81.00	50.00 U#	50.00 U#	100.00 U#	50.00 U#	50.00 U#	50.00 U#
GW-LPW-001	HH 010	/ /	5.00 U#	5.00 U#	19.00	5.00 U#	5.00 U#	10.00 U#	5.00 U#	5.00 U#	5.00 U#

VOLATILE ORGANICS ANALYSIS

SAMPLE NO	QTR NO	DATE	TETRACHLOR TETR	1 2 TET	TOLUENE	TOL	CHLOROBENZ	CB	ETHYLBENZ	ETHYL	STY	XYLENE	XYL	PENTANE	PENT	QUAL	PENTANE	3	PENT	QUAL
EW-E29-001	HH	003	10/31/88	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	230.00	5.00	5.00	5.00
EW-E29K-001	HH	004	10/31/88	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	260.00	5.00	5.00	5.00
EW-E29M-001	HH	005	10/31/88	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	140.00	5.00	5.00	5.00
EW-E29-001	HH	001	10/31/88	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	270.00	5.00	5.00	5.00
EW-E29W-001	HH	002	10/31/88	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	270.00	5.00	5.00	5.00
EW-E29F-001	HS	627	10/31/88	5.00 U#	5.00 U#	5.00 U#	12.00 #	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	410.00	5.00	5.00	5.00
EW-K71R-001	HH	006	11/01/88	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	130.00	5.00	5.00	5.00
EW-LP-001	HH	007	11/04/88	50.00 U#	50.00 U#	130.00 #	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	550.00	5.00	5.00	5.00
EW-LPJ-001	HH	009	11/04/88	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	170.00	5.00	5.00	5.00
EW-LPY-001	HH	008	11/04/88	50.00 U#	50.00 U#	120.00 #	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	50.00 U#	940.00	5.00	5.00	5.00
EW-LPM-001	HH	010	/ /	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	5.00 U#	199.00	5.00	5.00	5.00

VEGETABLE OILS ANALYSIS

SAMPLE NO	TR NO	DATE	RENT BEN	PROP PROP
SW-C2H-001	HH 003	10/31/88	0.00	0.00
SW-C2H-001	HH 004	10/31/88	0.00	0.00
SW-C2H-001	HH 005	10/31/88	0.00	0.00
SW-C2H-001	HH 001	10/31/88	0.00	0.00
SW-C2H-001	HH 002	10/31/88	0.00	0.00
SW-C2H-001	HC 627	10/31/88	17.00 #3 /JH	11.00 #3 /JH
SW-NT19-001	HH 006	11/01/88	0.00	0.00
SW-LP-001	HH 007	11/04/88	0.00	0.00
SW-LP1-001	HH 009	11/04/88	0.00	0.00
SW-LPK-001	HH 008	11/04/88	0.00	0.00
SW-LPM-001	HH 010	/ /	0.00	0.00

APPENDIX 5.2.4

SOILS RAW DATA

NITL TOWN SOIL ANALYSIS --- TASK 2

SAMPLE NO	TR NO	DATE	AL AL DUAL	SR SE DUAL	AS AS DUAL	BS BS DUAL	BE BE DUAL	CD CD DUAL	CA CA DUAL	CR CR DUAL
50-001	NHP 342	10/26/88	15100.00 #	5.00 UHH /RS	8.70 #	317.00 #	1.30 #	0.71 U#	8300.00 #	16.70 #
50-001-F	NHP 301	11/04/88	258.00	153.00 N	923.00 E	4.90	18.00 E	35.90 E	165000.00	82.20 E
50-002	NHP 343	10/26/88	12600.00 #	4.40 UHH /RS	6.30 #	279.00 #	1.10 #	0.62 U#	8210.00 #	14.40 #
50-003	NHP 344	10/26/88	14700.00 #	4.80 UHH /RS	4.50 #	456.00 #	0.87 #	0.67 U#	22300.00 #	10.50 #
50-004	NHP 345	10/26/88	14600.00 #	5.00 UHH /RS	9.00 #	284.00 #	1.20 #	0.70 U#	3030.00 #	12.00 #
50-005	NHP 346	10/26/88	12500.00 #	4.70 UHH /RS	7.60 #	352.00 #	1.10 #	0.66 U#	3520.00 #	11.50 #
50-006	NHP 347	10/26/88	14100.00 #	4.50 UHH /RS	8.50 #	380.00 #	1.10 #	0.64 U#	3210.00 #	11.80 #
50-007	NHP 348	10/26/88	10300.00 #	4.90 UHH /RS	4.20 #	168.00 #	1.20 #	1.00 # /JQ	2330.00 #	10.00 #
50-007-F	NHP 349	10/26/88	10000.00 #	4.90 UHH /RS	4.30 #	174.00 #	1.10 #	0.74 # /JQ	2880.00 #	8.90 #
52-008	NHP 350	10/26/88	11400.00 #	5.00 UHH /RS	5.90 #	314.00 #	1.20 #	0.71 U#	26800.00 #	12.30 #
50-009	NHP 351	10/26/88	13100.00 #	4.90 UHH /RS	5.80 #	282.00 #	1.10 #	0.69 U#	17600.00 #	11.10 #
50-010	NHP 352	10/26/88	13100.00 #	4.70 UHH /RS	4.70 #	257.00 #	1.10 #	0.66 U#	2950.00 #	5.10 #
50-011	NHP 353	10/26/88	11500.00 #	4.60 UHH /RS	4.90 #	234.00 #	0.95 #	0.64 U#	2580.00 #	8.00 #
50-012	NHP 354	10/26/88	9970.00 #	4.60 UHH /RS	5.70 #	261.00 #	0.95 #	0.64 U#	2610.00 #	5.00 #
50-012-J	NHP 247	10/28/88	18.70	22.10 U	1.30 UH	3.00 U	1.10	3.10 U	38.00 U	8.00 U
50-013	NHP 355	10/26/88	9720.00 #	4.60 UHH /RS	5.60 #	184.00 #	1.10 #	0.66 # /JQ	3140.00 #	10.60 #
50-014	NHP 356	10/26/88	9930.00 #	4.70 UHH /RS	4.90 #	197.00 #	1.10 #	0.66 U#	3360.00 #	10.30 #
50-015	NHP 357	10/26/88	8950.00 #	4.40 UHH /RS	4.30 #	140.00 #	1.00 #	0.75 # /JQ	2630.00 #	11.30 #
50-016	NHP 358	10/26/88	12800.00 #	4.40 UHH /RS	5.60 #	182.00 #	1.00 #	0.62 U#	3660.00 #	13.00 #
50-017	NHP 359	10/26/88	9680.00 #	4.60 UHH /RS	4.80 #	153.00 #	0.96 #	0.65 U#	3600.00 #	10.70 #
50-018	NHP 360	10/26/88	11700.00 #	4.50 UHH /RS	4.20 #	170.00 #	1.00 #	0.78 # /JQ	2900.00 #	12.30 #
50-019	NHP 364	10/27/88	22900.00	5.00 UH	5.90 #	535.00	1.20	0.70 U	4540.00	12.20
50-020	NHP 365	10/27/88	22100.00	4.70 UH	4.10 #	373.00	1.10	0.87	4680.00	11.20
50-021	NHP 366	10/27/88	18000.00	4.80 UH	8.90 #	286.00	1.10	0.74	3390.00	11.70
50-022-A	NHP 367	10/27/88	22800.00	4.70 UH	6.10 #	302.00	1.10	0.65 U	3560.00	13.40
50-022-B	NHP 368	10/27/88	12200.00	4.60 UH	4.90 #	192.00	0.98	0.64 U	6640.00	11.30
50-023-A	NHP 370	10/27/88	19400.00	4.70 UH	6.10 #	288.00	0.88	0.66 U	3620.00	10.00
50-023-B	NHP 369	10/27/88	12100.00	4.50 UH	4.70 #	168.00	1.10	0.64 U	2650.00	11.10
50-024-A	NHP 371	10/27/88	20900.00	4.60 UH	4.10 #	285.00	1.10	0.55 U	3460.00	10.70
50-024-B	NHP 372	10/27/88	11100.00	4.50 UH	4.60 #	160.00	1.10	0.64 U	2460.00	14.30
50-025	NHP 373	10/27/88	11900.00	4.70 UH	7.90 #	177.00	1.10	0.93	3360.00	12.70
50-025-A	NHP 280	10/27/88	12100.00	4.60 UH	8.70 #	183.00	1.10	0.95	3370.00	10.50
50-026	NHP 361	10/27/88	11000.00 #	4.50 UHH /RS	0.00	157.00 #	1.10 #	0.63 U#	2280.00 #	10.80 #
50-027	NHP 362	10/27/88	11900.00	4.60 UH	5.40 #	159.00	1.10	0.64 U	2790.00	10.90
50-027-J	NHP 272	10/27/88	17.60 #	22.10 UH	1.90 UH	5.00 UH	0.90 UH	3.10 UH*	53.40 #	8.00 UH /JQ
50-028	NHP 363	10/27/88	9910.00	4.50 UH	10.10 #	215.00	1.10	0.64 U	3650.00	10.20

MILLTOWN SOIL ANALYSIS --- TASK 2

SAMPLE NO	TR NO	DATE	AL EL DUAL	EB SE DUAL	AS AS DUAL	EA EA DUAL	BE BE DUAL	CD CD DUAL	CA CA DUAL	CR CR DUAL
50-029	NHJ 282	10/27/88	8510.00	4.60 U N	3.80 MS	195.00	1.10	0.64 U	4120.00	11.00
50-030	NHJ 281	10/27/88	12000.00	4.60 U N	7.50 ME	203.00	0.92	0.64 U	3130.00	11.40

MILLTOWN SOIL ANALYSIS --- TASK 2

SAMPLE NO	ITR NO	DATE	CO	CU	FE	PB	MG	MN	HG	NH
			OD	CU	FE	PB	MG	MN	HG	NH
			OD	CU	FE	PB	MG	MN	HG	NH
50-001	WHP 342	10/26/88	6.10 #	74.50 #*/JE	18100.00 #	17.80 #	7460.00 #	171.00 #	0.17 #/JH	11.00 #
50-001-P	WHJ 301	11/04/88	131.00 E	5860.00 E	19500.00 E	221.00	109500.00	193.00 E	18.60 N	48.80
50-002	WHP 343	10/26/88	5.90 #	35.40 #*/JI	15200.00 #	11.10 #	6900.00 #	324.00 #	0.12 #/JH	11.10 #
50-003	WHP 344	10/26/88	6.20 #	30.20 #*/JI	15900.00 #	12.20 #	11900.00 #	387.00 #	0.12 #/JH	7.90 #
50-004	WHP 345	10/26/88	7.60 #	30.20 #*/JI	18600.00 #	13.30 #S	5480.00 #	419.00 #	0.13 #/JH	10.30 #
50-005	WHP 346	10/26/88	6.90 #	31.20 #*/JI	16000.00 #	14.50 #	5240.00 #	325.00 #	0.11 U#/UJH	8.90 #
50-006	WHP 347	10/26/88	6.90 #	29.40 #*/JI	16300.00 #	14.90 #	5290.00 #	344.00 #	0.10 U#/UJH	8.90 #
50-007	WHP 348	10/26/88	4.00 #	15.70 #*/JI	11900.00 #	11.70 #	5590.00 #	380.00 #	0.10 U#/UJH	9.30 #
50-007-K	WHP 349	10/26/88	4.20 #	15.80 #*/JI	11900.00 #	9.90 #	5660.00 #	393.00 #	0.11 U#/UJH	8.80 #
50-008	WHP 350	10/26/88	4.80 #	17.60 #*/JI	12900.00 #	12.90 #S	9470.00 #	275.00 #	0.12 #/JH	9.70 #
50-009	WHP 351	10/26/88	5.90 #	19.30 #*/JI	14100.00 #	13.00 #	8090.00 #	351.00 #	0.10 U#/UJH	9.80 #
50-010	WHP 352	10/26/88	6.70 #	15.80 #*/JI	15900.00 #	10.50 #S	2000.00 #	480.00 #	0.10 U#/UJH	8.00 #
50-011	WHP 353	10/26/88	6.30 #	14.10 #*/JI	15600.00 #	7.50 #	1870.00 #	390.00 #	0.11 U#/UJH	7.60 #
50-012	WHP 354	10/26/88	6.60 #	13.30 #*/JI	14200.00 #	8.10 #	1550.00 #	443.00 #	0.10 U#/UJH	8.10 #
50-012-J	WHJ 247	10/28/88	8.70 U	4.60 U	22.60 U	1.60 U	50.60 U	1.80 U	0.20 U	15.70 U
50-013	WHP 355	10/26/88	4.60 #	17.10 #*/JI	11600.00 #	13.30 #S	3820.00 #	344.00 #	0.12 #/JH	8.10 #
50-014	WHP 356	10/26/88	4.90 #	17.50 #*/JI	12800.00 #	8.90 #	4700.00 #	379.00 #	0.11 U#/UJH	8.90 #
50-015	WHP 357	10/26/88	4.20 #	9.60 #*/JI	11600.00 #	7.80 #	2970.00 #	245.00 #	0.12 #/JH	9.30 #
50-016	WHP 358	10/26/88	5.50 #	12.50 #*/JI	13600.00 #	9.50 #	3580.00 #	396.00 #	0.10 U#/UJH	9.60 #
50-017	WHP 359	10/26/88	4.40 #	10.00 #*/JI	12200.00 #	12.90 #S	3260.00 #	328.00 #	0.10 U#/UJH	8.40 #
50-018	WHP 360	10/26/88	5.50 #	10.90 #*/JI	13500.00 #	8.60 #	3210.00 #	375.00 #	0.10 U#/UJH	8.70 #
50-019	WHP 364	10/27/88	8.70	24.90 *	17300.00	16.10 S	4920.00	992.00	0.40 N	10.40
50-020	WHP 365	10/27/88	8.50	25.70 *	16700.00	16.70 S	4350.00	752.00	0.32 N	9.80
50-021	WHP 366	10/27/88	8.30	25.80 *	15300.00	15.80	4940.00	608.00	0.36 N	9.50
50-022-A	WHP 367	10/27/88	8.00	22.10 *	16700.00	12.40	3920.00	611.00	0.32 N	8.70
50-022-B	WHP 368	10/27/88	5.50	15.40 *	13500.00	9.50	5270.00	384.00	0.34 N	8.70
50-023-A	WHP 370	10/27/88	8.90	20.10 *	15400.00	11.20 S	4480.00	609.00	0.29 N	9.90
50-023-B	WHP 369	10/27/88	5.90	11.80 *	12500.00	9.20	3560.00	341.00	0.37 N	7.60
50-024-A	WHP 371	10/27/88	7.70	17.80 #	15500.00	11.60	3940.00	559.00	0.10 U#	8.30
50-024-B	WHP 372	10/27/88	5.10	16.10 *	11700.00	10.50	3460.00	358.00	0.11 U#	8.70
50-025	WHJ 279	10/27/88	6.10	67.50 *	12700.00	16.80 S	3460.00	390.00	0.37 N	8.10
50-025-P	WHJ 280	10/27/88	5.60	47.00 *	13100.00	14.80	3460.00	403.00	0.11 U#	8.70
50-026	WHP 361	10/27/88	5.10 #	12.90 #*/JI	12200.00 #	10.50 #S	3090.00 #	345.00 #	0.11 #/JH	7.90 #
50-027	WHP 362	10/27/88	5.70	21.90 *	13100.00	9.80	4170.00	364.00	0.12 N	8.30
50-027-J	WHJ 272	10/27/88	8.70 U#	4.60 U#	32.20 #	0.80 U#	50.60 U#	2.60 #	0.20 U#	15.70 U#
50-028	WHP 363	10/27/88	5.20	24.10 *	11900.00	24.00	4140.00	374.00	0.34 N	8.10

05/09/89

MILLTOWN SOIL ANALYSIS --- TASK 2

SAMPLE NO	TR NO	DATE	CO CO QUAL	CU CU QUAL	FE FE QUAL	PB PB QUAL	MG MG QUAL	MN MN QUAL	HG HS QUAL	NI NI QUAL
80-027	MW 282	10/27/88	5.50	27.20 *	11800.00	24.70	4490.00	336.00	0.39 N	8.50
80-028	MW 281	10/27/88	6.40	25.30 *	13900.00	12.60 S	4920.00	360.00	0.27 W	9.10

05/09/89

HILLTOPH SOIL ANALYSIS --- TASK 2

SAMPLE NO	ITR NO	DATE	K K QUAL	SE SE QUAL	AS AS QUAL	MS MS QUAL	TH TH QUAL	VA VA QUAL	Z Z QUAL
50-001	HRP 342	10/26/88	2180.00 #	0.89 #/S	0.84 U#	441.00 #	0.32 U#NW/RS	22.10 #	69.80 #
50-001-P	HRP 301	11/04/88	47.00 U	36.30 S	14.90	71.50	40.20 S	61.00	163.00 E
50-002	HRP 343	10/26/88	2170.00 #	1.50 #NW/RE	0.74 U#	423.00 #	0.30 U#NW/RS	20.30 #	51.70 #
50-003	HRP 344	10/26/88	2770.00 #	1.70 #NW/RE	0.80 U#	158.00 #	0.31 U#NW/RS	14.30 #	56.20 #
50-004	HRP 345	10/26/88	2540.00 #	0.65 #NW/JS	0.33 U#	73.40 #	0.30 U#NW/RS	18.60 #	58.50 #
50-005	HRP 346	10/26/88	2800.00 #	1.30 #NS/JS	0.79 U#	63.10 #	0.29 U#NW/RS	14.30 #	60.40 #
50-006	HRP 347	10/26/88	3040.00 #	0.91 #NS/JS	0.76 U#	79.70 #	0.29 U#NW/RS	15.90 #	61.80 #
50-007	HRP 348	10/26/88	1630.00 #	0.61 #NW/JSSE	0.83 U#	132.00 #	0.30 U#NW/RS	14.70 #	41.30 #
50-007-K	HRP 349	10/26/88	1540.00 #	1.60 #NW/RE	0.81 U#	119.00 #	0.30 U#NW/RS	13.70 #	40.80 #
50-008	HRP 350	10/26/88	2030.00 #	0.57 #NW/RE	0.84 U#	161.00 #	0.31 U#NW/RS	18.10 #	40.90 #
50-009	HRP 351	10/26/88	2440.00 #	0.58 #NS/JS	0.82 U#	164.00 #	0.31 U#NW/RS	17.60 #	49.50 #
50-010	HRP 352	10/26/88	1720.00 #	0.70 #NW/JS	0.79 U#	80.60 #	0.29 U#NW/RS	18.80 #	52.90 #
50-011	HRP 353	10/26/88	1480.00 #	0.91 U#NW/RS	0.76 U#	73.20 #	0.30 U#NW/RS	18.20 #	45.90 #
50-012	HRP 354	10/26/88	1640.00 #	1.10 #NW/RE	0.76 U#	78.10 #	0.29 U#NW/RS	16.00 #	48.00 #
50-012-J	HRP 247	10/28/88	236.00 U	2.20 W	3.70 U	181.00 U	1.40 U W	2.80 U	11.70 U
50-013	HRP 355	10/26/88	2050.00 #	0.67 #NW/JS	0.77 U#	101.00 #	0.29 U#NW/RS	17.00 #	44.70 #
50-014	HRP 356	10/26/88	2000.00 #	1.60 #NW/RE	0.79 U#	87.30 #	0.29 U#NW/RS	20.20 #	38.80 #
50-015	HRP 357	10/26/88	1660.00 #	0.56 #NW/JS	0.73 U#	98.40 #	0.28 U#NW/RS	19.20 #	33.90 #
50-015	HRP 358	10/26/88	2810.00 #	0.95 #NW/RE	0.74 U#	94.10 #	0.28 U#NW/RS	21.40 #	42.10 #
50-017	HRP 359	10/26/88	2590.00 #	0.55 #NW/JS	0.77 U#	88.50 #	0.29 U#NW/RS	18.50 #	35.00 #
50-018	HRP 360	10/26/88	2580.00 #	1.30 #NW/JSSE	0.75 U#	99.30 #	0.27 U#NW/RS	21.30 #	37.90 #
50-019	HRP 364	10/27/88	2670.00	0.68 #+	0.84 U	111.00	0.30 U NW	23.20	74.50
50-020	HRP 365	10/27/88	2460.00	0.94 W	0.89	102.00	1.50 U NW	22.80	66.90
50-021	HRP 366	10/27/88	2350.00	0.48 #	0.80 U	87.50	0.30 U NW	20.90	67.60
50-022-4	HRP 367	10/27/88	2940.00	1.00 W	0.78	98.00	0.29 U NW	23.10	61.60
50-022-8	HRP 368	10/27/88	2330.00	0.54 W	0.76 U	94.10	0.28 U NW	18.60	44.10
50-023-0	HRP 370	10/27/88	2340.00	0.49 U	0.79 U	86.40	0.36 NW	20.40	54.60
50-023-8	HRP 369	10/27/88	2160.00	0.52 V	0.76 U	89.90	0.29 U NW	19.00	39.20
50-024-4	HRP 371	10/27/88	2280.00	0.55 W	0.78 U	97.70	0.30 NW	21.50	53.30
50-024-8	HRP 372	10/27/88	1830.00	0.61 W	0.76	70.90	0.29 U NW	17.00	42.40
50-025	HRP 279	10/27/88	2180.00	0.67 +	1.20	97.50	0.29 U NW	20.00	55.20
50-025-4	HRP 280	10/27/88	2260.00	0.47 +	0.77 U	98.20	0.29 U NW	20.90	55.00
50-026	HRP 361	10/27/88	1720.00 #	0.43 U#NW/RS	0.75 U#	96.90 #	0.29 U#NW/RS	19.10 #	36.00 #
50-027	HRP 362	10/27/88	2030.00	1.45 +	0.76 U	81.70	0.32 NW	19.70	49.60
50-027-J	HRP 272	10/27/88	236.00 U#	2.10 U#	3.70 U#	181.00 U#	1.10 U#	2.80 U#	11.70 U#
50-028	HRP 363	10/27/88	2050.00	0.63 W	0.76 U	66.40	0.29 U NW	19.30	61.20

05/09/89

MILLTOWN SOIL ANALYSIS --- TASK 2

SAMPLE NO	ITR NO	DATE	K K COUN	SE SE COUN	PG AG COUN	NA NA COUN	TH TH COUN	VA VA COUN	Z Z COUN
SQ-029	MHJ 282	10/27/88	2070.00	0.62 W	0.76 U	61.30	0.29 U NW	20.30	64.80
SQ-030	MHJ 281	10/27/88	2050.00	0.50 +	0.77 U	60.40	0.29 U NW	21.70	42.60

APPENDIX 5.3

DATA VALIDATION SUMMARY

Note: Two Data Validation Summaries are outstanding.
Formalization of these packages will be completed for
inclusion in the Final Milltown Downstream Screening
Study Report.

APPENDIX 5.3

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Note: Two Data Validation Summaries are outstanding. Formalization of these packages will be completed for inclusion in the Final Milltown Downstream Screening Study Report.



Case No. 10476 Project No. --
Site Milltown Reservoir Drawdown
Contract Laboratory Skinner & Sherman Laboratory
QC Report Number N/A Sample Delivery Group (SDG) MHJ 257
Sample Matrix 19 low waters
Sampling Date (Month/Year) 10,11/88
Type of Request/Analyses RAS Metals

Sample No.	<u>MHJ 257</u>	<u>MHJ 261</u>	<u>MHJ 265</u>	<u>MHJ 269</u>	<u>MHJ 273</u>
	<u>MHJ 258</u>	<u>MHJ 262</u>	<u>MHJ 266</u>	<u>MHJ 270</u>	<u>MHJ 274</u>
	<u>MHJ 259</u>	<u>MHJ 263</u>	<u>MHJ 267</u>	<u>MHJ 271</u>	<u>MHJ 275</u>
	MHJ 260	MHJ 264	MHJ 268	MHJ 272	

QA Review by Jessica Luthrie 3/25/89 CCJM Approval by PAC 3/27/89

DPO action requested? Yes No X

Following items require action

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

RAS Inorganic Data Inventory Checklist

P	Inorganic Cover Page
P	Inorganic analysis data sheets (Form I)
P	Initial calibration and calibration verification results (Form II)
P	Continuing calibration verification (Form II)
P	Blank results (Form III)
P	ICP interference check sample (Form IV)
P	Spike results (Form V)
P	Duplicate results (Form VI)
P	Instrument Detection limits (Form XI)
P	Laboratory Control Sample (LCS) Results (Form VII)
P	Serial Dilution Results (Form IX)
P	Raw data for samples
P	Raw data for calibration standards
P	Raw data for blanks
P	Raw data for ICP quality control (ICS and Serial Dilution)
P	Raw data for spikes
P	Raw data for duplicates
P	Raw data for LCS
P	Raw data for furnace AA
P	Raw data for mercury analysis
NR	Raw data for cyanide analysis
NA	Percent solids calculation - soils only
P	Sample prep/digestion logs
P	Traffic Reports
P	Method References
P	Sample description
P	2X CRDL ICP Analysis
NR	Case narrative

P = Provided in original data package

R = Provided as resubmission

NP = Not provided

NA = Not applicable

NR = Not required

I. Deliverables

- A. All deliverables were present as specified in the statement of work.

Yes X No

Comments: No comment.

II. Detection Limits

- A. All results met the contract required detection limits (CRDL).

Yes X No

Comments: No comments.

III. Holding Times

- A. All contract specified holding times were met.

Yes X No

Comments: No comment.

- B. All 40CFR136 recommended holding times were met (water holding times applied to soil matrices, if applicable).

Yes X No

Comments: No comment.

IV. Calibration Quality Control

- A. All initial instrument calibrations were performed as specified in the statement of work.

Yes X No

Comments: No comment.

- B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the contract specified frequency.

Yes X No

Comments: No comment.

- C. The ICV and CCV standard recovery results were within the contract specified control limits.

Yes X No

Comments: No comment.

- D. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the contract specified frequency.

Yes X No

Comments: No comment

- E. The ICB and CCB results were within the contract specified control limits.

Yes X No

Comment: No comment.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments: No comment.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments: No comment.

- C. All analytes in the preparation blank were less than two times the instrument detection limit (IDL).

Yes No X

Comments:

1. The following is a table of qualifiers, analytes, associated blank values and samples (with analyte values from the IDL to five times the amount found in the blank) associated with a possibly contaminated but contractually compliant preparation blank:

<u>Samples</u>	<u>Analyte</u>	<u>Associated Blank Value</u>	<u>Qualifier</u>
MHJ 259 - 263 MHJ 265, 271, 273	Lead	3.9B	JB

2. Lead results for the above samples could be biased high and the possibility exists that false positives have been reported.

VI. Accuracy Statements

A. Matrix (pre-digest) spike frequency was met.

Yes X No

Comments: MHJ 259 was used as a matrix spike.

B. Matrix spike recoveries were within contract specified control limits (75 - 125%).

Yes No X

Comments:

1. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>Recovery</u>	<u>Qualifier</u>
MHJ 261	Mercury	129	JS

2. The remainder of the samples in this SDG have undetected mercury results and require no qualification.
3. The mercury result for MHJ 261 could possibly be biased high.

C. All analysis (post digest) spike requirements were met for the above samples that required "N" flags. This is not required for GFAA analysis and applies to SOW 787 only.

Yes No Not Applicable X

Comments: No comment.

D. Laboratory control sample (LCS) frequency was met.

Yes X No

Comments: No comment.

E. LCS recoveries were within contract specified control limits (80-120%, except Ag and Sb for SOW 787).

Yes X No

Comments: No comment.

VII. Precision Statements

A. Matrix (pre-digest) duplicate frequency was met.

Yes X No

Comments: Sample MHJ 259 was used for matrix duplicate analysis.

B. Matrix (pre-digest) duplicate differences were within contract specified control limits (± 20 RPD or $\pm$ CRDL for results less than 5X the CRDL).

Yes X No

Comments:

1. The laboratory flagged the results for cadmium with a "*", indicating that the duplicate differences were not within the control limit. The laboratory was not required to calculate the RPD because one of the values is less than the CRDL. The laboratory-added flag is not necessary. No qualifier will be added by the reviewer.

VIII. ICP Quality Control

- A. Serial dilution frequency was met.

Yes X No

Comments: Sample MHJ 260 was used for serial dilution analysis.

- B. Differences for the serial dilution were within contract specified control limits (10% difference).

Yes X No

Comments: No comment.

- C. The CRDL check standard was run at the appropriate frequency for the analytes required.

Yes X No

Comments: Frequency and concentration of the CRDL check standard were appropriate.

- D. The CRDL check standard exhibited recoveries which indicate that linearity problems are not likely at the lower end of the calibration curve.

Yes No X

Comments:

1. The following is a table of samples, analytes and qualifiers associated with a problem in the CRDL solution.

<u>Sample</u>	<u>Analyte</u>	<u>Qualifier</u>
MHJ 257 - 275	Chromium	UJQ
MHJ 259, 260, 262 - 264, 267, 268	Manganese	UJQ

2. When the absolute difference between the expected value and the found value is greater than the instrument detection limit, an accuracy problem at the lower end of the calibration curve is indicated. For this reason, the above chromium and manganese sample results at or near the instrument detection limit are qualified as estimated, UJQ.

E. The interference check sample (ICS) frequency was met.

Yes X No

Comments: No comment.

F. ICS percent recovery results were reported for all required ICS analytes and were within contract specified control limits.

Yes X No

Comments: No comment.

G. No significant positive or negative values were reported for ICP analytes not contained in the standard ICS.

Yes X No

Comments: No comment.

IX. Graphite Furnace (GFAA) Quality Control

A. Duplicate injections were performed for all analyses (Method of Standard Addition (MSA) requires single injections only) and had RSDs of less than 20% where mean results were above the CRDL.

Yes X No

Comments: No comment.

- B. 1. Analysis (post digest) spikes were performed on all required samples and at the concentration (2X CRDL) required.

Yes X No

Comment: The laboratory encountered no problems during analysis of post digest spikes.

2. Sample dilution and re-spiking was performed on all samples whose initial spike %R was less than 40%.

Yes No NA X

Comments: Initial spike recoveries were acceptable.

- C. MSA was performed when required and followed the criteria specified in Exhibit E.

Yes No NA X

Comment: MSA was not required.

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(UJ) = Undetected but estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

-Q = Qualified due to reasons not stated above; see text of review

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (UJ-S)

(UJ) Meaning the reported undetected value of 200u is estimated
due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be
flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J)
due to spike recovery problems (-S).

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FEB 7 1989

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DOCUMENT NO.: MTROS017

C.C.J.M.

Project No. 667012100

FEB 15 1989

RECEIVED

QC Report Number N/A

Date 1/18/89

Date 1/31/80

Date 1/3/8-

Sampling Date (Month/Year) 10/88, 11/88

RAS Organics

HH004 HH008

HH005 HH009

HH006 HH010

HH007

- (X) Data have met analytical quality criteria and are within applicable guideline limits except where qualifiers are noted.
- () Data are preliminary - pending action or verification.
- () Data have not met analytical quality control criteria or applicable guideline limits.

Yes No X

Yes No X

Yes X No

Note:

-- The EPA Functional Guidelines for Evaluating Organics Analyses - (Data Review SOP) has been used by the data reviewer for determining the necessary data qualifiers, except as specifically noted in review comments.

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample data values to be qualified or data quality to be otherwise affected.

DATA COMPLETENESS CHECKLIST

X Included: no problems
* Included: problems noted in review
0 Not Included and/or Not Available
NR Not Required

X Case Narrative

Quality Control Summary Package

* Surrogate Recovery Summary (Form II)
* MS/MSD Summary (Form III)
* Reagent Blank Summary (Form IV)
X GC/MS Tuning and Mass Calibration (Form V)

Sample Data Package

* Holding Times (SMO Sample Traffic Reports)
X Organic Analysis Data Sheets (Form I) all four pages for each sample, arrange in increasing SMO no. order
X Reconstructed Ion Chromatogram(s) (RIC)
X GC/EC Chromatograms
X Quantitation Reports
X Mass Spectral Data
X EPA/NIH Mass Spectral Library Search for TIC's

Standards Data Package

X Current List of Laboratory/Instrumental Detection Limits
* Initial Calibration Data (Form VI) for each instrument
* Continuing Calibration Data (Form VII) for each instrument
X Pesticide Evaluation Standards Summary (Form VIII)
* Pesticide/PCB Standards Summary (Form IX)
X Pesticide/PCB Identification (Form X) if any positive results
X VOA and BNA Standards Reconstructed Ion Chromatograms (RIC)
X VOA and BNA Standards Quantitation Reports
X Pesticide/PCB Standard Chromatograms and Data System Printouts

Raw QC Data Package

X DFTPP and BFB mass spectra and mass listings
* Reagent Blank Data
X Organic Analysis Data Sheets (Form I)
X Reconstructed Ion Chromatograms (RIC)
X Quantitation Reports
X Mass Spectral Data
X EPA/NIH Library Search of TIC's
X GC/EC Chromatograms and Data System Printouts

* Matrix Spike and Matrix Spike Duplicate Data
X Organic Analysis Data Sheets (Form I)
X Reconstructed Ion Chromatograms (RIC)
X Quantitation Reports
X Mass Spectral Data
X EPA/NIH Library Search of TIC's
X GC/EC Chromatograms and Data System Printouts

I. Holding times

All samples were extracted and analyzed within required holding times.

Yes _____ No X

Based on the sampling date, samples HH001, HH002, HH003, HH004 and HH005 were analyzed one day past the 7 day holding time requirement for unpreserved VOA samples specified in the Federal Register 40CFR136. All aromatic results (benzene, toluene, xylenes, styrene, chlorobenzene, ethyl benzene) for these samples have been qualified as estimated (J-H, UJ-H).

All samples were extracted and analyzed within contract (SOW) holding times.

Yes X No _____

Sample Number	Sampling Date	VTSR	VOA Analysis	BNA Extract	BNA Analysis	Pesticide Extract	Pesticide Analysis
HH001	10/31/88	11/3/88	11/8/88	11/7/88	11/28/88	11/3/88	11/29/88
HH002	10/31/88	11/3/88	11/8/88	11/7/88	11/28/88	11/3/88	11/29/88
HH003	10/31/88	11/3/88	11/8/88	11/7/88	11/28/88	11/3/88	11/29/88
HH004	10/31/88	11/3/88	11/8/88	11/7/88	11/28/88	11/3/88	11/29/88
HH005	10/31/88	11/3/88	11/8/88	11/7/88	11/28/88	11/3/88	11/29/88
HH006	11/1/88	11/3/88	11/8/88	11/7/88	11/28/88	11/3/88	11/29/88
HG627	11/3/88	11/4/88	11/9/88	11/7/88	11/28/88	11/7/88	11/30/88
HH007	11/4/88	11/7/88	11/9/88	11/7/88	11/29/88	11/7/88	11/30/88
HH008	11/4/88	11/7/88	11/9/88	11/7/88	11/29/88	11/7/88	11/30/88
HH009	11/4/88	11/7/88	11/8/88	11/7/88	11/29/88	11/7/88	11/30/88
HH010	11/4/88	11/7/88	11/8/88	NA	NA	NA	NA

II. GC/MS Tuning and Mass Calibration

- A. The DFTPP performance results were all included and found to be within specified criteria.

Yes X No _____

- B. The BFB performance results were all included and found to be within specified criteria.

Yes X No _____

III. A. Instrument Calibration (SV and VOA)

1. The instrument response factor (RRF) data was reviewed for the initial and continuing calibrations. All appropriate information was present in the package and all response factors met the required criteria for volatile and semivolatile analyses.

Yes _____ No X

RRF values out of specifications are summarized on Table I and the resulting qualifiers are added to sample results (Form I).

2. The percent relative standard deviation (% RSD) data for the initial calibrations and the percent difference (%D) data for the continuing calibrations were reviewed. All % RSD and % D value met the required criteria for volatile and semivolatile analyses.

Yes _____ No X

% RSD and % D values out of specifications are summarized on Table I and the resulting qualifiers are added to sample results (Form I).

B. Instrument Calibration (Pesticide)

1. All linearity check criteria were met with a % RSD value less than 10 % for all quantitation column calibration.

Yes X No _____

2. The breakdown of 4,4'-DDT and endrin was less than 20% for all applicable standard analyses.

Yes X No _____

3. The pesticide standard compounds showed a %D of the calibration factor of no more than 15% for the quantitation runs and 20% for confirmation runs for all compounds identified.

Yes X No

4. The retention time of 4,4'-DDT was greater than 12 minutes for packed columns (except OV-101).

Yes X No

IV. Blanks

The blanks analysis were received. The frequency of blank extractions and analysis were within specified QC limits.

Yes X No

The contaminants detected in the blank samples are summarized on Table I (attached) and the resulting sample qualifiers are added to the sample results (Form I).

V. Surrogate Recovery

The surrogate recoveries were reviewed. The recoveries were all within specified QC criteria.

Yes No X

All VOA and BNA surrogate recoveries were within specified QC limits.

The pesticide surrogate recoveries for samples HH005 and HH006 were above the contract recommended limits; however, since no pesticides were detected in the samples, there is considered to be no effect on the reported data.

VI. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The matrix spike and matrix spike duplicate recovery data were reviewed. The spikes were performed and met all recommended QC specifications.

Yes No X

4-Nitrophenol was recovered above QC limits for the MS analyses of sample HH001 and Endrin was recovered below QC limits for the MSD analysis of sample HH003. Since neither compound was detected in the unspiked analysis of samples HH001 and HH003, there is considered to be no effect on the reported data.

VII. This case contained a field duplicate sample and the resulting data was reviewed.

Yes X No Not identified

The %RPD values for the duplicate analysis results of samples HH001 and HH008 are listed below (blank contaminants and tentatively identified compounds are not listed).

<u>Compound</u>	<u>HH007 (ug/L)</u>	<u>HH008 (ug/L)</u>	<u>%RPD</u>
Toluene	130	120	8
Phenol	140	170	19
4-Methylphenol	440	570	26
Benzoic Acid	320	360	12

VIII. Internal Standard (IS) Performance

The internal standard results were reviewed for consistency in response (area counts) and retention time. All sample Internal Standards showed adequate performance and consistency.

Yes X No

IX. TCL Compound Identification

All positive results were evaluated to determine that all criteria were met in identifying TCL compounds from the sample data. In all cases, the reported compounds matched the retention time and, when applicable, the mass spectral profile.

Yes X No

X. Compound quantitation and Reported Detection Limit

All quantitative and reported detection limits results were reviewed and were determined to be accurate.

Yes X No

XI. Tentatively Identified Compounds

All reported tentatively identified compounds data was reviewed and found to meet quantitative and qualitative criteria.

Yes X No

XII. System Performance

The instrumental and analytical systems used in the analysis of these samples maintained an appropriate level of performance throughout this case.

Yes X No

XIII. Overall Assessment of the Data in the Case

Data have met analytical quality criteria and are within applicable guideline limits except where qualifiers are noted.

Yes X No

XIV. Contract Violations

All contract requirements were met by the laboratory in the analyses of the samples in the package.

Yes X No

XV. Additional Comments

None.

EXPLANATION OF ORGANICS DATA QUALIFIERS

For the purposes of this data review document the following code letters and associated definitions are provided:

- U - The material was analyzed for, but was not detected. The associated numerical value is the estimated detection limit.
- R - Quality Control indicates that data is not usable (i.e. compound may or may not be present). Resampling and re-analysis are necessary to determine the presence or absence of the analyte in the sample.
- UJB - The compound is considered to be undetected and the value reported is an estimated detection limit because the compound was identified in the laboratory blank as well as in the sample. The value of this reported detection limit (DL) is determined by the amount of the compound found in the sample:
 - 1) the sample value was less than the CRDL: the DL is reported as equal to the CRDL.
 - 2) the sample value was greater than CRDL but less than 5X the amount of the compound found in the laboratory blank (less than 10X for methylene chloride, acetone, toluene and phthalates): the DL is reported as equal to the reported sample value.
 - 3) the sample value was greater than 5X the laboratory blank value (10X for compounds noted above): see JB qualifier.
- JB - The reported value is an estimated amount. The compound was detected in the blank and quantity reported in the sample is greater than 5X the amount found in the blank (greater than 10X for methylene chloride, acetone, toluene, and phthalates).
- M - Benzo(b) and Benzo(k) Fluoranthrene not separated due to matrix.
- J - The associated numerical value is an estimated quantity because the amount detected is below the required detection limits or because quality control criteria were not met. (See qualifiers listed below)
- JN - Tentative identification of a compound. Resampling and re-analysis are necessary for verification.
- JE - The value reported was estimated due to interference problems.
- JC - The value reported was estimated due to instrument calibration problems.
- JH - The value reported was estimated due to holding time violation.
- JS - The value reported was estimated due to surrogate or matrix spike recovery problems.

Polished
ET
2-1-81



JOHNSON & MALHOTRA, P.C.
ENVIRONMENTAL ENGINEERS

C.C.M.

FEB 15 1989

RECEIVED

DOCUMENT NO.: MTSIS015.RVW
SAS INORGANIC DATA REVIEW SUMMARY

Case No. 3952 H Project No. --
Site Milltown Reservoir Drawdown
Contract Laboratory JTC Environmental Consultants
QC Report Number 180 Sample Delivery Group (SDG)
Sample Matrix 28 Low Waters
Sampling Date (Month/Year) 7/88
Type of Request/Analyses CL, SO4, HC03/C03, TSS

Samples	<u>SWMP6-001</u>	<u>SWMP7-003</u>	<u>SWMP9-001</u>	<u>SWMP10-002</u>	<u>SWMP11-003N</u>
	<u>SWMP6-002</u>	<u>SWMP7-003N</u>	<u>SWMP9-002</u>	<u>SWMP10-003</u>	<u>SWGS10-001</u>
	<u>SWMP6-003</u>	<u>SWMP8-001</u>	<u>SWMP9-003</u>	<u>SWMP10-003N</u>	<u>SWGS10-002</u>
	<u>SWMP6-003N</u>	<u>SWMP8-002</u>	<u>SWMP9-003M</u>	<u>SWMP11-001</u>	<u>SWGS10-003</u>
	<u>SWMP7-001</u>	<u>SWMP8-003</u>	<u>SWMP9-003N</u>	<u>SWMP11-002</u>	<u></u>
	<u>SWMP7-002</u>	<u>SWMP8-003N</u>	<u>SWMP10-001</u>	<u>SWMP11-003</u>	<u></u>

Data Reviewer Sue Dalla Initials/Date SD 1-31-89

QA Review by J. Malhotra 1/31/89 220 1/31/89

Telephone logs enclosed? Yes X No

Contractual violations found? Yes X No

DPO action requested? Yes No X

Following items require action

Note:

Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

SAS Inorganic Data Completeness Checklist

<u>P</u>	Inorganic Cover Page
<u>P</u>	Tabulated inorganic analysis data sheets (Form I or equivalent)
<u>P</u>	Tabulated initial calibration and calibration verification results (Form II or equivalent)
<u>P</u>	Tabulated continuing calibration verification (Form II or equivalent)
<u>P</u>	Tabulated blank results (Form III or equivalent)
<u>NR</u>	Tabulated ICP interference check sample (Form IV or equivalent)
<u>P</u>	Tabulated spike results (Form V or equivalent)
<u>P</u>	Tabulated duplicate results (Form VI or equivalent)
<u>NP</u>	Tabulated Instrument Detection limits (Form VII or equivalent)
<u>NR</u>	Tabulated ICP Laboratory Control Sample (LCS) Results (Form VII or equivalent)
<u>NR</u>	Serial Dilution Results
<u>P</u>	Raw data for samples (all analyses)
<u>P</u>	Raw data for calibration standards (all analyses)
<u>P</u>	Raw data for blanks (all analyses)
<u>NR</u>	Raw data for ICP quality control (ICS and Serial Dilution all analyses)
<u>P</u>	Raw data for spikes (all analyses)
<u>P</u>	Raw data for duplicates (all analyses)
<u>P</u>	Raw data for LCS (all analyses)
<u>NR</u>	Raw data for furnace AA (all analyses)
<u>NR</u>	Raw data for mercury analysis (if applicable)
<u>NR</u>	Raw data for cyanide analysis (if applicable)
<u>NR</u>	Tabulated percent solids calculation - soils only (all samples)
<u>NR</u>	Tabulated sample prep/digestion logs (all samples)
<u>NP</u>	Traffic Reports/Packing Lists
<u>P</u>	Method References

P = Provided

R = Provided upon request

NP = Not provided

NR = Not required

SAS INORGANIC DATA REVIEW SUMMARY

ANALYTE(S): Cl, SO4, TSS, HCO3/CO3

- I. A. All deliverables were present as required (data summaries, QC summaries, raw data, calculations).

Yes No X

Comments:

Tabulated instrument detection limits and packing lists were not submitted as required by the SAS request.

- II. A. Contract-specified method(s) used.

Yes X No

Comments:

No comment.

- B. Contract-specified detection limits met.

Yes X No

Comments:

No comment.

- C. Contract/method holding times met.

Yes X No N/A

Comments:

No comment.

III. A. Initial calibration performed as per contract or method specification, correlation coefficient greater than or equal to 0.995, analytical sample data do not exceed calibration range.

Yes X No

Comments:

No comment.

B. Correct contract/method calculations performed.

Yes X No

Comments:

No comment.

C. Accurate raw data transcription to sample and QC summary sheets.

Yes X No

Comments:

No comment.

IV. A. Initial calibration blank (ICB) and verification (ICV) standards meet contract/method specifications (frequency, control limits, etc.).

Yes X No

Comments:

No comment.

- B. Continuing calibration blank (CCB) and verification (CCV) standards meet contract/method specifications (frequency, control limits, etc.).

Yes X No

Comments:

No comment.

- V. A. Preparation blank met contract/method specifications.

Yes X No

Comments:

No comment.

- B. Method control standard (MCS) met contract/method specifications.

Yes X No

Comments:

No comment.

- C. Duplicate sample met contract/method specifications.

Yes No X

Comments:

1. Samples SWMP8-001 and SWMP11-001 were used as matrix duplicates.

2. The following is a table of samples, analytes, differences and qualifiers associated with RPDs exceeding the RPD (+ 20% for waters, + 35% soils) or + CRDL control limits specified in the applicable documents.

<u>Samples</u>	<u>Analyte</u>	<u>RPD</u>	<u>Qualifier</u>
SWMP6-001, 002, 003, 003N SWMP7-001, 002, 003, 003N SWMP8-001, 002, 003, 003N SWMP9-001	SO ₄	42	J*

3. Duplicate precision for sulfate on sample SWMP8-001 exceeded the control limit of + 20% (see table above). The reported sulfate results (listed above) associated with this out of control duplicate are qualified as estimated, J*.

D. Matrix spike met contract/method specifications.

Yes _____ No X

Comments:

Samples SWMP8-001 and SWMP11-001 were used as matrix spikes.

1. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>% Recovery</u>	<u>Qualifier</u>
SWMP9-002, 003, 003M, 003N SWMP10-001, 002, 003, 003N SWGS10-001, 002, 003 SWMP11-001, 002, 003, 003N	SO ₄	22.4	RS, JS

2. The "undetected" sulfate results for samples SWMP9-003M and SWMP9-003N are qualified as unusable, RS, due to poor spike recovery. The possibility exists that these undetected results might be false negatives.

3. Positive sulfate results for the samples listed above are qualified as estimated, JS, due to poor spike recovery. These results could be biased significantly low and the reported positive results are the minimum concentrations at which sulfate is present in these samples.

VI. Other comments:

1. Results for total suspended solids analysis were not submitted for the following samples: SWMP6-001, 002, 003, 003N; SWMP7-001, 002, 003, 003N; SWMP8-001, 002, 003. The packing lists for these samples indicate that TSS is a requested parameter for all samples. The laboratory was contacted (phone log attached) for an explanation. The laboratory explained that the above samples were analyzed with a different QC group and resubmitted a summary form which included the missing TSS results.

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(U) = Undetected but reported detection limit is estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (U-S)

Meaning the reported detection limit (200u) is estimated (U) due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J) due to spike recovery problems (-S).

Released
2/1-89



JOHNSON & MALHOTRA,
ENVIRONMENTAL ENGINEERS

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FEB 7 1989

Quality Assurance
Management System

RAS INORGANIC DATA REVIEW SUMMARY

MTRIS016.RVW
C.C.J.M.

Case No. 3952 H Project No. --

Site Milltown Reservoir Drawdown FEB 15 1989

Contract Laboratory JTC Environmental Consultants RECEIVED

QC Report Number -- Sample Delivery Group (SDG) SWMP6001

Sample Matrix 27 low waters

Sampling Date (Month/Year) 7/88

Type of Request/Analyses Total Recoverable Metals

Sample No.	<u>SWGS10-001</u>	<u>SWMP10-003N</u>	<u>SWMP6-002</u>	<u>SWMP7-003N</u>	<u>SWMP9-002</u>
	<u>SWGS10-002</u>	<u>SWMP11-001</u>	<u>SWMP6-003</u>	<u>SWMP8-001</u>	<u>SWMP9-003</u>
	<u>SWGS10-003</u>	<u>SWMP11-002</u>	<u>SWMP6-003N</u>	<u>SWMP8-002</u>	<u>SWMP9-003M</u>
	<u>SWMP10-001</u>	<u>SWMP11-003</u>	<u>SWMP7-001</u>	<u>SWMP8-003</u>	
	<u>SWMP10-002</u>	<u>SWMP11-003N</u>	<u>SWMP7-002</u>	<u>SWMP8-003N</u>	
	<u>SWMP10-003</u>	<u>SWMP6-001</u>	<u>SWMP7-003</u>	<u>SWMP9-001</u>	

Data Reviewer Susan Dalla Initials/Date SD 2-20-89

QA Review by William Berning WB 1/31/89 RAS 1/3/89

Telephone logs enclosed? Yes X No

Contractual violations found? Yes X No

DPO action requested? Yes No X

Note:

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

RAS Inorganic Data Inventory Checklist

<u>P</u>	Inorganic Cover Page
<u>P</u>	Inorganic analysis data sheets (Form I)
<u>P</u>	Initial calibration and calibration verification results (Form II)
<u>P</u>	Continuing calibration verification (Form II)
<u>P</u>	Blank results (Form III)
<u>P</u>	ICP interference check sample (Form IV)
<u>P</u>	Spike results (Form V)
<u>P</u>	Duplicate results (Form VI)
<u>P</u>	Instrument Detection limits (Form XI)
<u>P</u>	Laboratory Control Sample (LCS) Results (Form VII)
<u>P</u>	Serial Dilution Results (Form IX)
<u>P</u>	Raw data for samples
<u>P</u>	Raw data for calibration standards
<u>P</u>	Raw data for blanks
<u>P</u>	Raw data for ICP quality control (ICS and Serial Dilution)
<u>P</u>	Raw data for spikes
<u>P</u>	Raw data for duplicates
<u>P</u>	Raw data for LCS
<u>P</u>	Raw data for furnace AA
<u>P</u>	Raw data for mercury analysis
<u>NR</u>	Raw data for cyanide analysis
<u>NR</u>	Percent solids calculation - soils only
<u>P</u>	Sample prep/digestion logs
<u>P</u>	Packing lists
<u>P</u>	Sample description
<u>P</u>	CRDL ICP Analysis
<u>P</u>	Case narrative

P = Provided in original data package

R = Provided as resubmission

NP = Not provided

NA = Not applicable

NR = Not required

I. Deliverables

- A. All deliverables were present as specified in the statement of work.

Yes X No

Comments:

No comment.

II. Detection Limits

- A. All results met the contract required detection limits (CRDL).

Yes X No

Comments:

No comment.

III. Holding Times

- A. All SAS specified holding times were met.

Yes No X

Comments:

1. The following is a table of samples and analytes with holding times not meeting SAS specifications, with holding time based on date received (verified time of sample receipt or VTSR) to date of analysis (VTSR is not inclusive).

<u>Sample Number</u>	<u>Analyte</u>	<u>Holding Time</u>
SWMP6-001, 002, 003, 003N	Mercury	28 days
SWMP7-001, 002, 003, 003N	Mercury	27 days
SWMP8-001, 002, 003, 003N	Mercury	27 days
All samples	All ICP and GFAA metals	34-45 days

2. SAS 3952H specified that all metals were to be analyzed within 26 days of verified time of sample receipt. The laboratory did not comply with this specification.

- B. All 40CFR136 recommended holding times were met (water holding times applied to soil matrices, if applicable).

Yes _____ No X

Comments:

1. The following is a table of samples and analytes with holding times not meeting 40CFR136 recommendations, with holding time based on date sampled to date of analysis (with collection date not inclusive):

<u>Sample Number</u>	<u>Analyte</u>	<u>Sampling Date</u>	<u>Analysis Date</u>	<u>Days HT Exceeded</u>	<u>Quali-fier</u>
SWMP6-001,002, 003,003N	Mercury	7/2/88	8/2/88	3	UJH,JH
SWMP7-001,002, 003,003N	Mercury	7/3/88	8/2/88	2	UJH,JH
SWMP8-001,002, 003,003N	Mercury	7/4/88	8/2/88	1	UJH

2. For the above samples, positive results for mercury could be biased low and the undetected values might be false negatives. Reported mercury results for samples listed above are qualified as estimated, UJH, JH, due to 40CFR136 holding time violations.

IV. Calibration Quality Control

- A. All initial instrument calibrations were performed as specified in the statement of work.

Yes X No

Comments:

No comment.

- B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- C. The ICV and CCV standard recovery results were within the contract specified control limits.

Yes X No

Comments:

No comment.

- D. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- E. The ICB and CCB results were within the contract specified control limits.

Yes X No

Comments:

No comment.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments:

No comment.

- C. All analytes in the preparation blank were less than two times the instrument detection limit (IDL).

Yes X No

Comments:

No comment.

VI. Accuracy Statements

A. Matrix (pre-digest) spike frequency was met.

Yes X No

Comments:

Samples SWMP7-001 and SWMP11-001 were used as matrix spikes. It was not possible to determine from the digest logs which samples were associated with each matrix spike. If the spike recovery for any analyte exceeds the control limits, all sample results for that analyte will be qualified.

B. Matrix spike recoveries were within contract specified control limits (75 - 125%).

Yes No X

Comments:

1. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Samples</u>	<u>Analytes</u>	<u>Percent Recoveries</u>	<u>Qualifiers</u>
All samples	Silver	28.6/0.0	RS
All samples	Antimony	28.1	RS/JS
All samples	Aluminum	51.5	UJS,JS
All samples	Cadmium	72.2	UJS,JS
All samples	Cobalt	74.4	UJS,JS
All samples	Lead	191.9	JS (positive results)
All samples	Arsenic	171.7	JS (positive results)

2. Results for silver and antimony which are reported as undetected values are qualified as unusable, RS, due to poor spike recovery. Such low spike recoveries are indicative of severe analytical deficiencies and the reported undetected values might be false negatives. Positive results reported for antimony are qualified as estimated, JS, and might be biased low.

3. Reported results for aluminum, cadmium and cobalt are qualified as estimated, UJS, JS, due to spike recoveries exceeding the control limits. Positive results for these analytes might be biased low and the possibility exists that the reported undetected results are false negatives.
4. Positive results reported for lead and arsenic are qualified as estimated, JS, due to spike recovery exceeding the control limits. These estimated results might be biased significantly high and results reported at or near the detection limits for these analytes might be false positives.

C. All analysis (post digest) spike requirements were met for the above samples that required "N" flags. This is not required for GFAA analysis and applies to Sow 787 only.

Yes _____ No X Not Applicable _____

Comments:

1. The following is a table of samples and analytes for which analysis (post-digest) spikes were required but not performed (i.e., contract criteria were not met):

<u>Sample</u>	<u>Analyte</u>
SWMP11-001	Aluminum

2. There is a notation on the cover page of the metals analysis package stating that "the post digest spike for aluminum will be included in the next data package."

D. Laboratory control sample (LCS) frequency was met.

Yes X No _____

Comments:

No comment.

- E. LCS recoveries were within contract specified control limits (80-120%, except Ag and Sb for SOW 787).

Yes X No

Comments:

No comment.

VII. Precision Statement

- A. Matrix (pre-digest) duplicate frequency was met.

Yes X No

Comments:

Samples SWMP7-001 and SWMP11-001 were used as matrix duplicates. It was not possible to determine from the digest logs which samples were associated with each matrix duplicate. If the duplicate RPD for any analyte exceeds the control limits, all sample results for that analyte will be qualified.

- B. Matrix (pre-digest) duplicate differences were within contract specified control limits (± 20 RPD or $\pm$ CRDL for results less than 5X the CRDL).

Yes No X

Comments:

- The following is a table of samples, analytes, differences and qualifiers associated with duplicate analyses with RPDs exceeding the RPD ($\pm 20\%$ for waters, $\pm 35\%$ for soils) or $\pm$ CRDL control limits specified in the Functional Guidelines:

<u>Samples</u>	<u>Analytes</u>	<u>Control Limit</u>	<u>Difference</u>	<u>Qualifier</u>
All samples	Sodium	$\pm 20\%$	145%	U*,J*
All samples	Zinc	± 20 ppb	78 ppb	U*,J*

2. Reported results for sodium and zinc are qualified as estimated, W*, J*, because duplicate precision exceeded the control limits. For sodium, the reported results should be considered highly questionable because the relative percent difference is greater than fifty. Qualitative presence of sodium is verified.
3. Aluminum and antimony were flagged by the laboratory for having duplicate RPDs out of control. This was not necessary because the sample results were less than the CRDL and the duplicate RPDs were not required to be calculated.

VIII. ICP Quality Control

- A. Serial dilution frequency was met.

Yes X No

Comments:

Sample SWMP11-001 was used for the serial dilution analysis.

- B. Differences for the serial dilution were within contract specified control limits (10% difference).

Yes No X

Comments:

1. The following is a table of samples, analytes, differences and qualifiers associated with a serial dilution exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>Difference</u>	<u>Qualifier</u>
All samples	Calcium	23.3	WE,JE

2. The laboratory flagged the calcium results as "E" as required by contract. Calcium results are qualified as estimated WE, JE, due to the serial dilution exceeding the control limit. A chemical or physical interference should be suspected.

- C. The CRDL check standard was run at the appropriate frequency for the analytes required.

Yes X No

Comments:

No comment.

- D. The CRDL check standard exhibited recoveries which indicate that linearity problems are not likely at the lower end of the calibration curve.

Yes X No

Comments:

No comment.

- E. The interference check sample (ICS) frequency was met.

Yes X No

Comments:

No comment.

- F. ICS percent recovery results were reported for all required ICS analytes and were within contract specified control limits.

Yes X No

Comments:

No comment.

- G. No significant positive or negative values were reported for ICP analytes not contained in the standard ICS.

Yes X No

Comments:

No comment.

IX. Graphite furnace (GFAA) Quality Control

- A. Duplicate injections were performed for all analyses (Method of Standard Addition (MSA) requires single injections only) and had RSDs of less than 20% where mean results were above the CRDL.

Yes X No

Comments:

No comment.

- B. 1. Analysis (post digest) spikes were performed on all required samples and at the concentration (2X CRDL) required.

Yes X No

Comments:

No comment.

2. Sample dilution and re-spiking was performed on all samples whose initial spike %R was less than 40%.

Yes No N/A X

Comments:

No comment.

- C. MSA was performed when required and followed the criteria specified in Exhibit E.

Yes X No

Comments:

No comment.

X. General Comments

1. Sample SWMP9-003N is listed on the packing list as having been submitted to the laboratory for metals and SAS analyses. There are no metals results for this sample in the package. The laboratory was contacted (phone log attached) for an explanation. The laboratory explained that this sample was initially overlooked and was analyzed with the next QC set (#182).

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(UJ) = Undetected but estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (UJ-S)

Meaning the reported (200u) is estimated (UJ)
due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be
flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J)
due to spike recovery problems (-S).

Card EH
12-21-88

C.C. JOHNSON & MALHOTRA, P.C.

DOCUMENT NO.: MIRIS006

RAS INORGANIC DATA REVIEW SUMMARY

C. C. J. A.
FILE
COPY

Case No. 9912 Project No. --

Site Milltown Reservoir Drawdown

Contract Laboratory Rocky Mountain Analytical Laboratory

QC Report Number 87903 Sample Delivery Group (SDG) MHJ 349

Sample Matrix 20 low waters

Sampling Date (Month/Year) 7/88

Type of Request/Analyses Total Metals

Sample No.	<u>MHJ 349</u>	<u>MHJ 353</u>	<u>MHJ 357</u>	<u>MHJ 361</u>	<u>MHJ 365</u>
	<u>MHJ 350</u>	<u>MHJ 354</u>	<u>MHJ 358</u>	<u>MHJ 362</u>	<u>MHJ 366</u>
	<u>MHJ 351</u>	<u>MHJ 355</u>	<u>MHJ 359</u>	<u>MHJ 363</u>	<u>MHJ 367</u>
	<u>MHJ 352</u>	<u>MHJ 356</u>	<u>MHJ 360</u>	<u>MHJ 364</u>	<u>MHJ 368</u>

Data Reviewer Susan Dalla Initials/Date SD 11-3-88

QA Review by Rob Strode R 11/7/88 14

Telephone logs enclosed? Yes X No ---

Contractual violations found? Yes --- No X

DPO action requested? Yes --- No X

Following items require action ---

Note:

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

RAS Inorganic Data Inventory Checklist

<u>P</u>	Inorganic Cover Page
<u>P</u>	Inorganic analysis data sheets (Form I)
<u>P</u>	Initial calibration and calibration verification results (Form II)
<u>P</u>	Continuing calibration verification (Form II)
<u>P</u>	Blank results (Form III)
<u>P</u>	ICP interference check sample (Form IV)
<u>P</u>	Spike results (Form V)
<u>P</u>	Duplicate results (Form VI)
<u>P</u>	Instrument Detection limits (Form XI)
<u>P</u>	Laboratory Control Sample (LCS) Results (Form VII)
<u>P</u>	Serial Dilution Results (Form IX)
<u>P</u>	Raw data for samples
<u>P</u>	Raw data for calibration standards
<u>P</u>	Raw data for blanks
<u>P</u>	Raw data for ICP quality control (ICS and Serial Dilution)
<u>P</u>	Raw data for spikes
<u>P</u>	Raw data for duplicates
<u>P</u>	Raw data for LCS
<u>P</u>	Raw data for furnace AA
<u>P</u>	Raw data for mercury analysis
<u>NR</u>	Raw data for cyanide analysis
<u>NA</u>	Percent solids calculation - soils only
<u>P</u>	Sample prep/digestion logs
<u>P</u>	Traffic Reports
<u>P</u>	Sample description
<u>P</u>	2X CRDL ICP Analysis (Form 2B)
<u>P</u>	Case narrative

P = Provided in original data package

R = Provided as resubmission

NP = Not provided

NA = Not applicable

NR = Not required

I. Deliverables

- A. All deliverables were present as specified in the statement of work.

Yes X No

II. Detection Limits

- A. All results met the contract required detection limits (CRDL).

Yes X No

Comments:

No comment.

III. Holding Times

- A. All contract specified holding times were met.

Yes X No

Comments:

1. Form 10 (Holding Times) incorrectly lists the VTSR for samples MHJ 366-368 as 7/7/88. It is actually 7/8/88 according to the Traffic Reports for these samples. The analyses for these samples were run within the required holding times.

- B. All 40CFR136 recommended holding times were met (water holding times applied to soil matrices, if applicable).

Yes X No

Comments:

No comment.

IV. Calibration Quality Control

- A. All initial instrument calibrations were performed as specified in the statement of work.

Yes X No

Comments:

No comment.

- B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- C. The ICV and CCV standard recovery results were within the contract specified control limits.

Yes X No

Comments:

No comment.

- D. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- E. The ICB and CCB results were within the contract specified control limits.

Yes X No

1. Potassium was detected in CCB1 at a level greater than two times the instrument detection limit. No samples were bracketed by this blank, so no qualifiers will be added by the reviewer.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments:

No comment.

- C. All analytes in the preparation blank were less than two times the instrument detection limit (IDL).

Yes _____ No X

Comments:

1. The following is a table of qualifiers, analytes, associated blank values and samples (with analyte values from the IDL to five times the amount found in the blank) associated with a possibly contaminated but contractually compliant preparation blank:

<u>Samples</u>	<u>Analyte</u>	<u>Associated Blank Value</u>	<u>Qualifier</u>
MHJ 349 to 368	Zinc	10.3	JB

2. There is an inherent variability in the zinc data for the above samples. The possibility exists that the zinc results for these samples might be biased high.
3. Because the following reported positive zinc results are lower than the amount of zinc found in the preparation blank, the zinc results for these samples might be false positives: MHJ 350, 351, 356, 359, 360, 364, 366, 368.

VI. Accuracy Statements

- A. Matrix (pre-digest) spike frequency was met.

Yes X No _____

Comments:

Sample MHJ 367 was used as a matrix spike.

- B. Matrix spike recoveries were within contract specified control limits (75 - 125%).

Yes _____ No X

Comments:

1. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>% Recovery</u>	<u>Qualifier</u>
All	Vanadium	0	UJS

2. The laboratory was contacted regarding the spike recovery for vanadium because it was suspected that this analyte was omitted from the spiking solution. The laboratory confirmed this possibility. The support data from the continuing calibration verifications indicates that the instrument used was operating properly. Based on the acceptable results of the laboratory control sample and the interference check sample (no interferences were detected at levels high enough to cause problems), these undetected sample results for vanadium will not be rejected as stated in the SOP but will be qualified as estimated, UJS.

- C. All analysis (post digest) spike requirements were met for the above samples that required "N" flags. This is not required for GFAA analysis and applies to Sow 787 only.

Yes X No _____ Not Applicable _____

Comments:

Post-digest spike analysis of sample MHJ 367 had an acceptable vanadium spike recovery (108%), further supporting the decision to estimate the vanadium results rather than rejecting them.

D. Laboratory control sample (LCS) frequency was met.

Yes X No

Comments:

No comment.

E. LCS recoveries were within contract specified control limits (80-120%, except Ag and Sb for SOW 787).

Yes X No

Comments:

No comment.

VII. Precision Statement

A. Matrix (pre-digest) duplicate frequency was met.

Yes X No

Comments:

1. Sample MHJ 366 was used as a matrix duplicate.

- B. Matrix (pre-digest) duplicate differences were within contract specified control limits (± 20 RPD or $\pm$ CRDL for results less than 5X the CRDL).

Yes _____ No X

Comments:

1. The following is a table of samples, analytes, differences and qualifiers associated with duplicate results exceeding the RPD ($\pm 20\%$ for waters, $\pm 35\%$ for soils) or $\pm$ CRDL control limits specified in the Functional Guidelines:

<u>Samples</u>	<u>Analyte</u>	<u>Control Limit</u>	<u>Difference</u>	<u>Qualifier</u>
MHJ 349 to 368	lead	5 ppb	5.5 ppb	J*

2. All reported lead results are qualified as estimated, J*, due to duplicate precision exceeding the control limits.

VIII. ICP Quality Control

- A. Serial dilution frequency was met.

Yes X No _____

Comments:

A serial dilution was analyzed on Sample MHJ 368.

- B. Differences for the serial dilution were within contract specified control limits (10% difference).

Yes X No _____

Comments:

No comment.

- C. The CRDL check standard was run at the appropriate frequency for the analytes required.

Yes X No

Comments:

No comment.

- D. The CRDL check standard exhibited recoveries which indicate that linearity problems are not likely at the lower end of the calibration curve.

Yes X No

Comments:

No comment.

- E. The interference check sample (ICS) frequency was met.

Yes X No

Comments:

No comment.

- F. ICS percent recovery results were reported for all required ICS analytes and were within contract specified control limits.

Yes X No

Comments:

No comment.

- G. No significant positive or negative values were reported for ICP analytes not contained in the standard ICS.

Yes X No

Comments:

No comment.

IX. Graphite furnace (GFAA) Quality Control

- A. Duplicate injections were performed for all analyses (Method of Standard Addition (MSA) requires single injections only) and had RSDs of less than 20% where mean results were above the CRDL.

Yes X No

Comments:

No comment.

- B. 1. Analysis (post digest) spikes were performed on all required samples and at the concentration (2X CRDL) required.

Yes X No

No comment.

2. Sample dilution and re-spiking was performed on all samples whose initial spike %R was less than 40%.

Yes X No

Comments:

No comment.

- C. MSA was performed when required and followed the criteria specified in Exhibit E.

Yes X No

1. The following is a table of samples, analytes and qualifiers associated with poor MSA correlation:

<u>Sample</u>	<u>Analyte</u>	<u>Correlation</u>	<u>Qualifier</u>
---------------	----------------	--------------------	------------------

MHJ 366	Lead	.988, .990	JE
---------	------	------------	----

2. The positive lead result for sample MHJ 366 has been qualified as estimated, JE, due to poor MSA correlation coefficients.

X. General Comments

1. The laboratory flagged results when required and no calculation or transcription errors were found.

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(U) = Undetected but reported detection limit is estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

-Q = Qualified due to reasons not stated above - see text of report

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (U-S)

Meaning the reported detection limit (200u) is estimated (U) due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J) due to spike recovery problems (-S).

Revised.
EH 12-21-88



C. C. J. M.
FILE
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DOCUMENT NO.: MTRIS008.RVW
RAS INORGANIC DATA REVIEW SUMMARY

Case No. 10205 Project No. --

Site Milltown Reservoir Drawdown

Contract Laboratory Laucks Testing Labs

QC Report Number 11584 Sample Delivery Group (SDG) MHQ 801

Sample Matrix 16 low sediments

Sampling Date (Month/Year) 6,7/88

Type of Request/Analyses RAS Metals

Sample No.	<u>MHQ 801</u>	<u>MHQ 809</u>	<u>MHQ 818</u>	<u>MHQ 826</u>	<u> </u>
	<u>MHQ 803</u>	<u>MHQ 811</u>	<u>MHQ 820</u>	<u>MHQ 828</u>	<u> </u>
	<u>MHQ 805</u>	<u>MHQ 813</u>	<u>MHQ 822</u>	<u>MHQ 830</u>	<u> </u>
	<u>MHQ 807</u>	<u>MHQ 814</u>	<u>MHQ 824</u>	<u>MHQ 832</u>	<u> </u>

Data Reviewer Susan Dalla Initials/Date SD 11-9-88

QA Review by Rob Strode yes for NLS

Telephone logs enclosed? Yes X No

Contractual violations found? Yes No X

DPO action requested? Yes No X

Following items require action

Note:

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

RAS Inorganic Data Inventory Checklist

<u>P</u>	Inorganic Cover Page
<u>P</u>	Inorganic analysis data sheets (Form I)
<u>P</u>	Initial calibration and calibration verification results (Form II)
<u>P</u>	Continuing calibration verification (Form II)
<u>P</u>	Blank results (Form III)
<u>P</u>	ICP interference check sample (Form IV)
<u>P</u>	Spike results (Form V)
<u>P</u>	Duplicate results (Form VI)
<u>P</u>	Instrument Detection limits (Form XI)
<u>P</u>	Laboratory Control Sample (LCS) Results (Form VII)
<u>P</u>	Serial Dilution Results (Form IX)
<u>P</u>	Raw data for samples
<u>P</u>	Raw data for calibration standards
<u>P</u>	Raw data for blanks
<u>P</u>	Raw data for ICP quality control (ICS and Serial Dilution)
<u>P</u>	Raw data for spikes
<u>P</u>	Raw data for duplicates
<u>P</u>	Raw data for LCS
<u>P</u>	Raw data for furnace AA
<u>P</u>	Raw data for mercury analysis
<u>NR</u>	Raw data for cyanide analysis
<u>P</u>	Percent solids calculation - soils only
<u>P</u>	Sample prep/digestion logs
<u>P</u>	Traffic Reports
<u>P</u>	Sample description
<u>P</u>	2X CRDL ICP Analysis (Form II B)
<u>P</u>	Case narrative

P = Provided in original data package

R = Provided as resubmission

NP = Not provided

NA = Not applicable

NR = Not required

I. Deliverables

- A. All deliverables were present as specified in the statement of work.

Yes X No

II. Detection Limits

- A. All results met the contract required detection limits (CRDL).

Yes X No

Comments:

No comment.

III. Holding Times

- A. All contract specified holding times were met.

Yes X No

Comments:

No comment.

- B. All 40CFR136 recommended holding times were met (water holding times applied to soil matrices, if applicable).

Yes X No

Comments:

1. The following is a table of samples and analytes with holding times not meeting 40CFR136 recommendations, with holding time based on date sampled to date of analysis (with collection date not inclusive):

<u>Sample Number</u>	<u>Analyte</u>	<u>Sampling Date</u>	<u>Analysis Date</u>	<u>Days HT Exceeded</u>	<u>Qualifier</u>
MHQ 801	Mercury	06/27/88	09/01/88	36	JH
MHQ 803	Mercury	06/27/88	09/01/88	36	UJH
MHQ 805	Mercury	06/27/88	09/01/88	36	JH
MHQ 807	Mercury	07/06/88	09/01/88, 9/05/88	31	JH
MHQ 809	Mercury	07/06/88	09/01/88	27	UJH
MHQ 811	Mercury	07/06/88	09/01/88	27	JH
MHQ 813	Mercury	07/06/88	09/01/88, 9/05/88	31	JH
MHQ 814	Mercury	07/10/88	09/01/88	23	JH
MHQ 818	Mercury	07/25/88	09/01/88	8	JH
MHQ 820	Mercury	07/25/88	09/01/88	8	UJH
MHQ 822	Mercury	07/25/88	09/01/88	8	UJH
MHQ 824	Mercury	07/25/88	09/01/88	8	JH
MHQ 826	Mercury	07/27/88	09/01/88	6	JH
MHQ 828	Mercury	07/27/88	09/01/88	6	UJH
MHQ 830	Mercury	07/27/88	09/01/88	6	JH
MHQ 832	Mercury	07/27/88	09/01/88, 9/05/88	10	JH

2. These samples were held in the field for 21-51 days before shipment to the laboratory. Reported positive results for mercury might be biased low and the possibility exists that the reported "undetected" values might be false negatives.

IV. Calibration Quality Control

- A. All initial instrument calibrations were performed as specified in the statement of work.

Yes X No

Comments:

No comment.

- B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- C. The ICV and CCV standard recovery results were within the contract specified control limits.

Yes X No

Comments:

No comment.

- D. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- E. The ICB and CCB results were within the contract specified control limits.

Yes X No

Comments:

No comment.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments:

No comment.

- C. All analytes in the preparation blank were less than two times the instrument detection limit (IDL).

Yes X No

Comments:

No comment.

VI. Accuracy Statements

- A. Matrix (pre-digest) spike frequency was met.

Yes X No

Comments:

Sample MHQ 807 was used as a matrix spike. The Traffic Report designated this sample as "extra volume" for QC purposes.

- B. Matrix spike recoveries were within contract specified control limits (75 - 125%).

Yes _____ No X

Comments:

1. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>% Recovery</u>	<u>Qualifier</u>
All samples	Arsenic	234	JS
All samples	Antimony	31.6	UJS, JS

2. Due to a miscalculation of the selenium spike, the laboratory flagged all selenium results on the Forms I as "N" (out of control limits). The laboratory was contacted (phone log attached) and agrees that the % recovery for the selenium spike is acceptable and will submit corrected Forms I and V.

- C. All analysis (post digest) spike requirements were met for the above samples that required "N" flags. This is not required for GFAA analysis and applies to Sow 787 only.

Yes _____ No _____ Not Applicable X

Comments:

All analytes requiring "N" flags were GFAA analytes, so no post digest spikes were required.

- D. Laboratory control sample (LCS) frequency was met.

Yes X No _____

Comments:

No comment.

- E. LCS recoveries were within contract specified control limits (80-120%, except Ag and Sb for SOW 787).

Yes X No

Comments:

1. Aluminum, cadmium and arsenic have recoveries exceeding the 80-120% control limit (for aqueous LCS). The Functional Guidelines state that "all solid LCS results must fall within the control limits established by EPA." The following is a table of analytes, % recoveries, found values and EPA control limits:

<u>Analyte</u>	<u>% Recovery</u>	<u>Found Value mg/kg</u>	<u>EPA Control Limit mg/kg</u>
Aluminum	79	257	225-424
Arsenic	124	1138	635-1199
Cadmium	79	36	36-55

2. The above analytes are within the control limits established by the EPA for solid LCS samples, and no qualifiers will be added by the reviewer.

VII. Precision Statement

- A. Matrix (pre-digest) duplicate frequency was met.

Yes X No

Comments:

1. Sample MHQ 807 was used as a matrix duplicate. The Traffic Report designated this sample as "extra volume" for QC purposes.

- B. Matrix (pre-digest) duplicate differences were within contract specified control limits (± 20 RPD or $\pm$ CRDL for results less than 5X the CRDL).

Yes X No

Comments:

1. Q. C. Form VI lists a duplicate RPD of 36.5 for nickel. The result for sample MHQ 807 is less than five times the CRDL, so the control limit is ± 7.6 mg/kg (CRDL). The duplicate results for nickel are within the CRDL control limit and no qualifier will be added by the reviewer.
2. QC Form VI lists an RPD of 67.7 for beryllium. The laboratory was not required to calculate the RPD because the duplicate results were less than the CRDL. No qualifiers will be added by the reviewer.
3. The duplicate sample result for arsenic was incorrectly calculated, resulting in an RPD of 132. The laboratory was contacted (phone log attached) and will submit a corrected Form VI. The corrected duplicate RPD for arsenic (22.3) still exceeds the control limit established by SOW 787, so the laboratory-added "*" qualifier will not be removed. These are soil samples; no qualifier will be added by the reviewer because the control limit for soils is $\pm 35\%$.

VIII. ICP Quality Control

- A. Serial dilution frequency was met.

Yes X No

Comments:

Sample MHQ 807 was used for the required serial dilution.

- B. Differences for the serial dilution were within contract specified control limits (10% difference).

Yes _____ No X

Comments:

1. The following is a table of samples, analytes, differences and qualifiers associated with a serial dilution exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>% Difference</u>	<u>Qualifier</u>
All samples	Zinc	10.1	JE

2. The laboratory correctly flagged all zinc results with an "E" because the zinc concentration of sample MHQ 807 was minimally a factor of 10 above the instrument detection limit after dilution and the analyses were not within 10% of one another. Zinc results will be qualified as estimated, JE, due to exceeding contract specified control limits. A chemical or physical interference effect should be suspected.

- C. The CRDL check standard was run at the appropriate frequency for the analytes required.

Yes X No _____

Comments:

No comment.

- D. The CRDL check standard exhibited recoveries which indicate that linearity problems are not likely at the lower end of the calibration curve.

Yes X No _____

Comments:

No comment.

E. The interference check sample (ICS) frequency was met.

Yes X No

Comments:

No comment.

F. ICS percent recovery results were reported for all required ICS analytes and were within contract specified control limits.

Yes X No

Comments:

No comment.

G. No significant positive or negative values were reported for ICP analytes not contained in the standard ICS.

Yes X No

Comments:

No comment.

IX. Graphite furnace (GFAA) Quality Control

A. Duplicate injections were performed for all analyses (Method of Standard Addition (MSA) requires single injections only) and had RSDs of less than 20% where mean results were above the CRDL.

Yes X No

Comments:

No comment.

- B. 1. Analysis (post digest) spikes were performed on all required samples and at the concentration (2X CRDL) required.

Yes X No

The laboratory correctly flagged as "W" selenium results for all samples except MHQ 813 and MHQ 832 because the post-digest spikes for furnace AA analysis exceeded the control limits (85%-115%), while sample absorbances were less than 50% of the spike absorbances.

2. Sample dilution and re-spiking was performed on all samples whose initial spike %R was less than 40%.

Yes X No

Comments:

No comment.

- C. MSA was performed when required and followed the criteria specified in Exhibit E.

Yes X No

Comments:

No comment.

X. General Comments

1. The Case Narrative contains the following statement:
"Although Sb is always analyzed by graphite furnace, the ICP digest is analyzed because of the contractual requirement on Page D-6. Therefore when calculating soil results, the ICP digest weight must be used." Inspection of the raw data indicates that the GFAA digest weights were used in calculating the antimony results. The laboratory was contacted (phone log attached) and will correct and resubmit Forms I.
2. There was insufficient sample to perform % Total Solids for MHQ 805, MHQ 811, MHQ 813, MHQ 824, and MHQ 832. The results are all on "as received" basis.
3. The following calculation or reporting errors were found in this data package:

<u>Sample</u>	<u>Analyte</u>	<u>Reported</u>	<u>Recalculated Value</u>
MHQ 807S	As	89.36 mg/kg	35.42 mg/kg
MHQ 807S	As	934 %	234 %
MHQ 807S	Se	171 %	100 %
MHQ 807D	As	84.7 mg/kg	21.8 mg/kg
MHQ 807D	As	131.7 RPD	22.3 RPD
MHQ 818	Hg	4.9 mg/kg	0.49 mg/kg
MHQ 822	Hg	0.01 u	0.1 u
MHQ 826	Hg	0.01 mg/kg	0.74 mg/kg

The laboratory was contacted (phone log attached) and will resubmit the corrections.

Definition of Qualifiers (Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(UJ) = Undetected but reported detection limit is estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

-Q = Qualified due to reasons not stated above - see text of report

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (UJ-S)

Meaning the reported detection limit (200u) is estimated (UJ) due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J) due to spike recovery problems (-S).

Released:

EH 12-21-88



JOHNSON & MALHOTRA, P.C.
ENVIRONMENTAL ENGINEERS

C. C. J. M.
FILE
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DOCUMENT NO.: MTRIS005.RVW
RAS INORGANIC DATA REVIEW SUMMARY

Case No. 10000 Project No. --

Site Milltown Reservoir Drawdown

Contract Laboratory Rocky Mountain Analytical Laboratory

QC Report Number RMA QC #87904 Sample Delivery Group (SDG) MHJ 369

Sample Matrix 20 low waters

Sampling Date (Month/Year) 7/88

Type of Request/Analyses RAS Metals

Sample No.	<u>MHJ 369</u>	<u>MHJ 373</u>	<u>MHJ 377</u>	<u>MHJ 381</u>	<u>MHJ 385</u>
	<u>MHJ 370</u>	<u>MHJ 374</u>	<u>MHJ 378</u>	<u>MHJ 382</u>	<u>MHJ 386</u>
	<u>MHJ 371</u>	<u>MHJ 375</u>	<u>MHJ 379</u>	<u>MHJ 383</u>	<u>MHJ 387</u>
	<u>MHJ 372</u>	<u>MHJ 376</u>	<u>MHJ 380</u>	<u>MHJ 384</u>	<u>MHJ 388</u>

Data Reviewer Susan Dalla Initials/Date SD 11-12-88

QA Review by Rob Strode ip for BS

Telephone logs enclosed? Yes X No

Contractual violations found? Yes No X

DPO action requested? Yes No X

Following items require action

Note:

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

RAS Inorganic Data Inventory Checklist

<u>P</u>	Inorganic Cover Page
<u>P</u>	Inorganic analysis data sheets (Form I)
<u>P</u>	Initial calibration and calibration verification results (Form II)
<u>P</u>	Continuing calibration verification (Form II)
<u>P</u>	Blank results (Form III)
<u>P</u>	ICP interference check sample (Form IV)
<u>P</u>	Spike results (Form V)
<u>P</u>	Duplicate results (Form VI)
<u>P</u>	Instrument Detection limits (Form XI)
<u>P</u>	Laboratory Control Sample (LCS) Results (Form VII)
<u>P</u>	Serial Dilution Results (Form IX)
<u>P</u>	Raw data for samples
<u>P</u>	Raw data for calibration standards
<u>P</u>	Raw data for blanks
<u>P</u>	Raw data for ICP quality control (ICS and Serial Dilution)
<u>P</u>	Raw data for spikes
<u>P</u>	Raw data for duplicates
<u>P</u>	Raw data for LCS
<u>P</u>	Raw data for furnace AA
<u>P</u>	Raw data for mercury analysis
<u>NR</u>	Raw data for cyanide analysis
<u>NA</u>	Percent solids calculation - soils only
<u>P</u>	Sample prep/digestion logs
<u>P</u>	Traffic Reports
<u>P</u>	Sample description
<u>P</u>	2X CRDL ICP Analysis
<u>P</u>	Case narrative

P = Provided in original data package

R = Provided as resubmission

NP = Not provided

NA = Not applicable

NR = Not required

I. Deliverables

- A. All deliverables were present as specified in the statement of work.

Yes X No

II. Detection Limits

- A. All results met the contract required detection limits (CRDL).

Yes X No

Comments:

1. Based on the range of continuing calibration blank values for zinc, the low detection limit for zinc (2 ug/l) reported by the laboratory is in doubt.

III. Holding Times

- A. All contract specified holding times were met.

Yes X No

Comments:

No comment.

- B. All 40CFR136 recommended holding times were met (water holding times applied to soil matrices, if applicable).

Yes X No

Comments:

No comment.

IV. Calibration Quality Control

- A. All initial instrument calibrations were performed as specified in the statement of work.

Yes X No

Comments:

No comment.

- B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- C. The ICV and CCV standard recovery results were within the contract specified control limits.

Yes X No

Comments:

No comment.

- D. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- E. The ICB and OCB results were within the contract specified control limits.

Yes X No

See comment under II A.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments:

No comment.

Released:

EH 12-21-88



JOHNSON & MALHOTRA, P.C.
ENVIRONMENTAL ENGINEERS

C. C. J. M.
FILE
C. C. J. M.

DOCUMENT NO.: MTRIS005.RVW

RAS INORGANIC DATA REVIEW SUMMARY

Case No. 10000 Project No. --

Site Milltown Reservoir Drawdown

Contract Laboratory Rocky Mountain Analytical Laboratory

QC Report Number RMA QC #87904 Sample Delivery Group (SDG) MHJ 369

Sample Matrix 20 low waters

Sampling Date (Month/Year) 7/88

Type of Request/Analyses RAS Metals

Sample No.	<u>MHJ 369</u>	<u>MHJ 373</u>	<u>MHJ 377</u>	<u>MHJ 381</u>	<u>MHJ 385</u>
	<u>MHJ 370</u>	<u>MHJ 374</u>	<u>MHJ 378</u>	<u>MHJ 382</u>	<u>MHJ 386</u>
	<u>MHJ 371</u>	<u>MHJ 375</u>	<u>MHJ 379</u>	<u>MHJ 383</u>	<u>MHJ 387</u>
	<u>MHJ 372</u>	<u>MHJ 376</u>	<u>MHJ 380</u>	<u>MHJ 384</u>	<u>MHJ 388</u>

Data Reviewer Susan Dalla Initials/Date SD 11-12-88

QA Review by Rob Strode *ip for BS*

Telephone logs enclosed? Yes X No

Contractual violations found? Yes No X

DPO action requested? Yes No X

Following items require action

Note:

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

I. Deliverables

- A. All deliverables were present as specified in the statement of work.

Yes X No

II. Detection Limits

- A. All results met the contract required detection limits (CRDL).

Yes X No

Comments:

1. Based on the range of continuing calibration blank values for zinc, the low detection limit for zinc (2 ug/l) reported by the laboratory is in doubt.

III. Holding Times

- A. All contract specified holding times were met.

Yes X No

Comments:

No comment.

- B. All 40CFR136 recommended holding times were met (water holding times applied to soil matrices, if applicable).

Yes X No

Comments:

No comment.

- E. The ICB and OCB results were within the contract specified control limits.

Yes X No

See comment under II A.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments:

No comment.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments:

No comment.

- C. All analytes in the preparation blank were less than two times the instrument detection limit (IDL).

Yes _____ No X

Comments:

1. The following is a table of qualifiers, analytes, associated blank values and samples (with analyte values from the IDL to five times the amount found in the blank) associated with a possibly contaminated but contractually compliant preparation blank:

<u>Samples</u>	<u>Analyte</u>	<u>Associated Blank Value</u>	<u>Qualifier</u>
MHJ 369, 370 372 to 379, 382 to 385, 387, 388	Zn	12.3	JB

2. There is an inherent variability in the zinc data for the above samples. The possibility exists that the zinc results for these samples might be biased high.
3. Because the reported zinc results are lower than the amount of zinc found in the preparation blank, zinc results for the following samples might be false positives: MHJ 372, 373, 376, 378, 382, 383, 385, 387, 388.

VI. Accuracy Statements

- A. Matrix (pre-digest) spike frequency was met.

Yes X No _____

Comments:

MHJ 370 was used as a matrix spike.

- B. Matrix spike recoveries were within contract specified control limits (75 - 125%).

Yes _____ No X

Comments:

1. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>Recovery</u>	<u>Qualifier</u>
All	Thallium	66.2	UJS

2. The laboratory correctly flagged as "N" the GFAA analytical results for thallium. The reported results for thallium are qualified as estimated, UJS, due to poor spike recovery. These results might be biased low and the possibility of false negatives being reported exists.
3. There is a notation on Form 5A stating "Lead spike value determined by MSA." There is no evidence to support this in the raw data.

- C. All analysis (post digest) spike requirements were met for the above samples that required "N" flags. This is not required for GFAA analysis and applies to Sow 787 only.

Yes X No _____ Not Applicable _____

Comments:

No comment.

- D. Laboratory control sample (LCS) frequency was met.

Yes X No _____

Comments:

No comment.

- E. LCS recoveries were within contract specified control limits (80-120%, except Ag and Sb for SOW 787).

Yes X No

Comments:

No comment.

VII. Precision Statement

- A. Matrix (pre-digest) duplicate frequency was met.

Yes X No

Comments:

Sample MHJ 369 was used for matrix duplicate analysis.

- B. Matrix (pre-digest) duplicate differences were within contract specified control limits (± 20 RPD or $\pm$ CRDL for results less than 5X the CRDL).

Yes No X

Comments:

- The following is a table of samples, analytes, differences and qualifiers associated with duplicate results exceeding the RPD ($\pm 20\%$ for waters, $\pm 35\%$ for soils) or $\pm$ CRDL control limits specified in the Functional Guidelines:

<u>Sample</u>	<u>Analyte</u>	<u>Control Limit</u>	<u>Difference</u>	<u>Qualifier</u>
All	lead	5 ppb	19 ppb	U*, J*
All	zinc	20 %	26 %	J*

- Reported results for lead and zinc are qualified as estimated, U*, J*, due to duplicate precision exceeding the control limits.

VIII. ICP Quality Control

- A. Serial dilution frequency was met.

Yes X No

Comments:

Sample MHJ 388 was used for serial dilution analysis.

- B. Differences for the serial dilution were within contract specified control limits (10% difference).

Yes X No

Comments:

No comment.

- C. The CRDL check standard was run at the appropriate frequency for the analytes required.

Yes X No

Comments:

Frequency and concentration of the CRDL check standard were appropriate.

- D. The CRDL check standard exhibited recoveries which indicate that linearity problems are not likely at the lower end of the calibration curve.

Yes _____ No X

Comments:

1. The following is a table of samples, analytes and qualifiers associated with a problem in the CRDL solution.

<u>Sample</u>	<u>Analyte</u>	<u>Qualifier</u>
MHJ 369, 371, 374 to 377, 379, 381, 384 to 388	Copper	JQ
MHJ 369, 370, 372 to 379, 382 to 385, 387, 388	Zinc	JQ

2. When the difference between the expected value and the found value is greater than the instrument detection limit, an accuracy problem at the lower end of the calibration curve is indicated. For this reason, the above zinc and copper sample results at or near the reported IDL are qualified as estimated, JQ.

- E. The interference check sample (ICS) frequency was met.

Yes X No _____

Comments:

No comment.

- F. ICS percent recovery results were reported for all required ICS analytes and were within contract specified control limits.

Yes X No

Comments:

No comment.

- G. No significant positive or negative values were reported for ICP analytes not contained in the standard ICS.

Yes X No

Comments:

No comment.

IX. Graphite furnace (GFAA) Quality Control

- A. Duplicate injections were performed for all analyses (Method of Standard Addition (MSA) requires single injections only) and had RSDs of less than 20% where mean results were above the CRDL.

Yes X No

Comments:

No comment.

- B. 1. Analysis (post digest) spikes were performed on all required samples and at the concentration (2X CRDL) required.

Yes X No

1. The laboratory correctly flagged as "W" some of the selenium, thallium and lead results because the post-digestion spikes for furnace AA analysis were out of control limits (85 - 115%) while sample absorbance were less than 50% of the spike absorbances.
2. Sample dilution and re-spiking was performed on all samples whose initial spike %R was less than 40%.

Yes X No

Comments:

No comment.

- C. MSA was performed when required and followed the criteria specified in Exhibit E.

Yes X No

1. Lead analysis on sample MHJ 371 was run by MSA and an acceptable correlation coefficient was obtained.

X. General Comments

1. All calculations and transcriptions in this data package were found to be correct.

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(U) = Undetected but reported detection limit is estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

-Q = Qualified due to reasons not stated above - see text of report

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (U-S)

Meaning the reported detection limit (200u) is estimated (U) due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J) due to spike recovery problems (-S).



RAS INORGANIC DATA REVIEW SUMMARY

Type of Request/Analyses RAS metals, SAS digestion, no CN

Sample No.	MHP342	MHP346	MHP350	MHP354	MHP358
	MHP343	MHP347	MHP351	MHP355	MHP359
	MHP344	MHP348	MHP352	MHP356	MHP360
	MHP345	MHP349	MHP353	MHP357	MHP361

John Hadley, Checklisting
Data Reviewer Jeralyn Guthrie

Initials/Date *JH* 3/27/89

QA Review by Lucy R. Allen ^{SR} 3-28-89

CCJM Approval Ronald A. Chastain 3/28/89

Telephone logs enclosed? Yes No X

Contractual violations found? Yes No X

DPO action requested? Yes No X

Following items require action

Note:

-- The EPA Functional Guidelines for Evaluating Inorganics Analyses (Data Review SOP) has been used by the reviewer as a basis for reviewing the data and applying qualifiers.

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

RAS Inorganic Data Completeness Checklist

<u>P</u>	Inorganic Cover Page
<u>P</u>	Inorganic analysis data sheets (Form I)
<u>P</u>	Initial calibration and calibration verification results (Form II)
<u>P</u>	Continuing calibration verification (Form II)
<u>P</u>	Blank results (Form III)
<u>P</u>	ICP interference check sample (Form IV)
<u>P</u>	Spike results (Form V)
<u>P</u>	Duplicate results (Form VI)
<u>P</u>	Instrument Detection limits (Form VII or Form XI)
<u>P</u>	Laboratory Control Sample (LCS) Results (Form VII)
<u>P</u>	Serial Dilution Results (Form IX)
<u>P</u>	Raw data for samples
<u>P</u>	Raw data for calibration standards
<u>P</u>	Raw data for blanks
<u>P</u>	Raw data for ICP quality control (ICS and Serial Dilution)
<u>P</u>	Raw data for spikes
<u>P</u>	Raw data for duplicates
<u>P</u>	Raw data for LCS
<u>P</u>	Raw data for furnace AA
<u>P</u>	Raw data for mercury analysis
<u>NR</u>	Raw data for cyanide analysis
<u>P</u>	Percent solids calculation - soils only
<u>P</u>	Sample prep/digestion logs
<u>P</u>	Traffic Reports
<u>P</u>	Sample description
<u>P</u>	CRDL Analysis
<u>NR</u>	Case narrative

P = Provided in original data package

R = Provided as resubmission

NP = Not provided

NA = Not applicable

NR = Not required

I. A. All deliverables were present as specified in the statement of work.

Yes X No

Comments: No Comments

II. Detection Limits

A. All results met the contract required detection limits (CRDL).

Yes X No

Comments: No Comments.

III. Holding Times

A. All contract specified holding times were met.

Yes X No

Comments: No Comments.

- B. All 40CFR136 recommended holding times were met (water holding times applied to soil matrices, if applicable).

Yes _____ No X

Comments:

1. The following is a table of samples and analytes with holding times not meeting 40CFR136 recommendations, with holding time based on date sampled to date of analysis (with collection date not inclusive):

<u>Sample Number</u>	<u>Analyte</u>	<u>Sampling Date</u>	<u>Analysis Date</u>	<u>Days HT Exceeded</u>	<u>Qualifier</u>
MHP342-MHP360	Hg	10/26/88	12/1/88	8	JH/UJH
MHP361	Hg	10/27/88	12/1/88	7	JH

These soil samples have been qualified due to holding times having been exceeded based on criteria for water, per current Region VIII policy. The reported positive mercury results may be biased low and the possibility exists that false negatives have been reported.

IV. Calibration Quality Control

- A. All initial instrument calibrations were performed as specified in the statement of work.

Yes X No _____

Comments: No comments.

- B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the contract specified frequency.

Yes X No _____

Comments: No comments.

- C. The ICV and CCV standard recovery results were within the contract specified control limits.

Yes X No _____

Comments: No comments.

- D. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the contract specified frequency.

Yes X No

Comments: No comments.

- E. The ICB and CCB results were within the contract specified control limits.

Yes X No

1. Although within contract criteria the CCB results for copper were rather inconsistent in that the values varied from positive values greater than the IDL to negative values with an absolute value greater than the IDL. In the reviewer's opinion no qualifiers are required due to this problem alone.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments: No comments.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments: No comments.

- C. All analytes in the preparation blank were less than two times the instrument detection limit (IDL).

Yes X No

Comments: No comments.

VI. Accuracy Statements

A. Matrix (pre-digest) spike frequency was met.

Yes X No

Comments: No comments.

B. Matrix spike recoveries were within contract specified control limits (75 - 125%).

Yes No X

Comments:

1. The matrix spiked sample is MHP 343.
2. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Sample</u>	<u>Analyte</u>	<u>Recovery</u>	<u>Qualifier</u> (undetecteds/positives)
MHB342-MHB361	Sb	27.1%	RS/--
MHP342-MHP361	Se	18.3%	RS/JS
MHP342-MHP361	Tl	6.0%	RS/--

3. Due to these very low matrix spike recoveries all undetected values have been rejected (R) for antimony, selenium, and thallium since the possibility of false negatives would be very likely. The positive selenium values are likely biased very low and are qualified as estimated (JS).

C. All analysis (post digest) spike requirements were met for the above samples that required "N" flags. This is not required for GFAA analysis and applies to Sow 787 only.

Yes X No Not Applicable

Comments: No comments.

D. Laboratory control sample (LCS) frequency was met.

Yes X No

Comments: No comments.

E. LCS recoveries were within contract specified control limits (80-120%, except Ag and Sb for SOW 787).

Yes X No

Comments: The control limits specified for the solid LCS were met. An aqueous LCS is not required for SOW 787 with soil sample analyses.

VII. Precision Statement

A. Matrix (pre-digest) duplicate frequency was met.

Yes X No

Comments: No comments.

B. Matrix (pre-digest) duplicate differences were within contract specified control limits (± 20 RPD or $\pm$ CRDL for results less than 5X the CRDL).

Yes No X

Comments:

1. The sample used for duplicate analysis is MHP 342.

2. The lab has correctly noted that for copper the RPD has exceeded the contract specified limits; however the 29.8 RPD found does not exceed the Functional Guideline specified criteria of ± 35 RPD for qualifying soil samples during data validation, so no qualifier will be added by the reviewer.

VIII. ICP Quality Control

A. Serial dilution frequency was met.

Yes X No

- B. Differences for the serial dilution were within contract specified control limits (10% difference).

Yes X No

Comments:

1. The contract specified control limits which require that the initial analysis must be greater than 50 times the IDL was not exceeded for copper in the serially diluted sample (MHP 344), however the difference between the original and dilution analysis was 94.7% with the calculated value for the dilution being much higher (ie., almost double). This results in the dilution corrected final value for the copper result in the serial dilution being well over 50 times the IDL and indicates that an interference may be present. The reviewer's professional opinion is that all positive Cu results should be considered as estimated, possibly biased low. Positive Cu results have been qualified "JE", indicating an interference.

- C. The CRDL check standard was run at the appropriate frequency for the analytes required.

Yes X No

Comments: No comments.

- D. The CRDL check standard exhibited recoveries which indicate that linearity problems are not likely at the lower end of the calibration curve.

Yes No X

Comments:

1. The following is a table of samples, analytes and qualifiers associated with a problem in the CRDL solution.

<u>Sample</u>	<u>Analyte</u>	<u>Qualifiers</u>
MHP 348	Cd	JQ
MHP 349	Cd	JQ
MHP 355	Cd	JQ
MHP 357	Cd	JQ
MHP 360	Cd	JQ

2. The above noted problems for Cd are as result of the 2X CRDL standard being sufficiently higher than the true value which indicates that a bias may exist for sample values reported near the detection limit. Linearity problems at the low end of the curve were noted for other elements, however the sample values reported for those analytes should not have been affected since amounts found were all well above detection limits.

- E. The interference check sample (ICS) frequency was met for ICP analysis.

Yes X No

Comments: No comments.

- F. ICS percent recovery results were reported for all required ICS analytes and were within contract specified control limits.

Yes X No

- G. Significant positive or negative values were not reported for ICP analytes not contained in the standard ICS.

Yes X No

Comments: It was noted that the Zn values in Soln. A, which contains only the interferent analytes were very inconsistent (ie., values near the detection limit may be inaccurate), but the reported Zn values for samples were high enough to expect that no problems exist.

IX. GFAA Quality Control

- A. Duplicate injections were performed for all GFAA analyses (Method of Standard Addition (MSA) requires single injections only) and had RSDs of less than 20% where mean results were above the CRDL.

Yes X No

Comments: No comments.

- B. GFAA analysis (post-digest) spikes were performed on all required samples and at the concentration (2X CRDL) required.

Yes X No

Comments: No comments.

- C. Sample dilution and re-spiking was performed (if required) on any samples whose initial spike %R was less than 40%.

Yes X No

Comments: No comments.

- D. MSA was performed when required for GFAA analysis and followed the criteria specified in Exhibit E of the Statement of Work.

Yes X No

Comments:

1. The following is a table of samples, analytes, correlations (best one reported) and qualifiers associated with poor MSA correlation:

Sample	Analyte	Correlation	Qualifier
MHP343	Se	0.9666	RE
MHP344	Se	0.9883	RE
MHP348	Se	0.9948	JE
MHP349	Se	0.9823	RE
MHP350	Se	0.9763	RE
MHP354	Se	0.9864	RE
MHP356	Se	0.9771	RE
MHP358	Se	0.9886	RE
MHP360	Se	0.9933	JE

X. General Comments

No additional comments.

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(UJ) = Undetected but estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

- H = Qualified due to holding time violation
- E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)
- I = Qualified due to exceeding ICP linear range
- * = Qualified due to duplicate control limits being exceeded
- S = Qualified due to matrix spike recoveries outside control limits
- C = Qualified due to instrument calibration problems
- L = Qualified due to LCS recoveries outside control limits
- B = Qualified due to blank contamination problems
- Q = Qualified due to reasons not stated above; see text of review

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (UJ-S)

meaning the number being reported at the detection limit (200u) is estimated (UJ) due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., Al 250) will be flagged as follows:

Al 250 (J-S)

meaning the reported positive result (250) is estimated (J) due to spike recovery problems (-S).



JOHNSON & MALHOTRA, P.C.
ENVIRONMENTAL ENGINEERS

DOCUMENT NO.: MTRIS024.RVW

RAS INORGANIC DATA REVIEW SUMMARY

Case No. 10746/4233H Project No. --

Site Milltown Downstream Screening Study

Contract Laboratory Skinner & Sherman Laboratory

QC Report Number N/A Sample Delivery Group (SDG) MHQ 709

Sample Matrix 2 Low Soils

Sampling Date (Month/Year) 10/88

Type of Request/Analyses RAS Metals (No Cyanide)

Sample No. MHQ 709

MHQ 715

Data Reviewer William J. Berning Initials/Date WJB 3/29/89

QA Review by Susan Dalla CCJM Approval: [Signature] 3/28/89 RAC

Telephone logs enclosed? Yes X No

Contractual violations found? Yes No X

DPO action requested? Yes No X

Following items require action None

Note:

-- The EPA Functional Guidelines for Evaluating Inorganics Analyses (Data Review SOP) has been used by the reviewer as a basis for applying qualifiers.

-- Please see data qualifier definitions on the last page. This scheme of qualifiers is intended to help indicate the reasons or problems which cause sample values to be qualified.

RAS Inorganic Data Inventory Checklist

<u>P</u>	Inorganic Cover Page
<u>P</u>	Inorganic analysis data sheets (Form I)
<u>P</u>	Initial calibration and calibration verification results (Form II)
<u>P</u>	Continuing calibration verification (Form II)
<u>P</u>	Blank results (Form III)
<u>P</u>	ICP interference check sample (Form IV)
<u>P</u>	Spike results (Form V)
<u>P</u>	Duplicate results (Form VI)
<u>P</u>	Instrument Detection limits (Form XI)
<u>P</u>	Laboratory Control Sample (LCS) Results (Form VII)
<u>P</u>	Serial Dilution Results (Form IX)
<u>P</u>	Raw data for samples
<u>P</u>	Raw data for calibration standards
<u>P</u>	Raw data for blanks
<u>P</u>	Raw data for ICP quality control (ICS and Serial Dilution)
<u>P</u>	Raw data for spikes
<u>P</u>	Raw data for duplicates
<u>P</u>	Raw data for LCS
<u>P</u>	Raw data for furnace AA
<u>P</u>	Raw data for mercury analysis
<u>NR</u>	Raw data for cyanide analysis
<u>P</u>	Percent solids calculation - soils only
<u>P</u>	Sample prep/digestion logs
<u>P</u>	Traffic Reports
<u>P</u>	Method References
<u>P</u>	Sample description
<u>P</u>	2X CRDL ICP Analysis
<u>NR</u>	Case narrative

P = Provided in original data package

R = Provided as resubmission

NP = Not provided

NA = Not applicable

NR = Not required

I. Deliverables

- A. All deliverables were present as specified in the statement of work.

Yes X No

Comments: No comment.

II. Detection Limits

- A. All results met the contract required detection limits (CRDL).

Yes X No

Comments: No comments.

III. Holding Times

- A. All contract specified holding times were met.

Yes X No

Comments: No comment.

- B. All 40CFR136 recommended holding times were met (per Region 8 requirements, water holding times are applied to soils for purposes of data qualification).

Yes No X

Comments: Please note that the lab was compliant in this analysis.

Following is a table listing those samples affected by holding time problems, this may result in the possibility of positive values being biased low and undetected values being false negatives.

Sample #	Analyte	Sampling Date	Analysis Date	Days HT Exceeded	Flag
MHQ 709	Mercury	10/19/88	12/8/88	22	J-H
MHQ 715	Mercury	10/20/88	12/8/88	21	U-H

IV. Calibration Quality Control

- A. All initial instrument calibrations were performed as specified in the statement of work.

Yes X No

Comments: No comment.

- B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the contract specified frequency.

Yes X No

Comments: No comment.

- C. The ICV and CCV standard recovery results were within the contract specified control limits.

Yes X No

Comments: No comment.

- D. The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the contract specified frequency.

Yes X No

Comments: No comment

- E. The ICB and CCB results were within the contract specified control limits.

Yes X No

Comment: No comment.

V. Preparation Blank Quality Control

- A. A Preparation blank was prepared and analyzed at the contract specified frequency.

Yes X No

Comments: No comment.

- B. All analytes in the preparation blank were below the CRDL.

Yes X No

Comments: No comment.

- C. All analytes in the preparation blank were less than two times the instrument detection limit (IDL).

Yes X No

Comments: No Comments.

VI. Accuracy Statements

- A. Matrix (pre-digest) spike frequency was met.

Yes X No

Comments: No comments.

- B. Matrix spike recoveries were within contract specified control limits (75 - 125%).

Yes No X

Comments: Sample MHQ 715 was used for matrix spike analysis.

1. The following is a table of samples, analytes, recoveries and qualifiers associated with spike recoveries exceeding the contract specified control limits:

<u>Samples</u>	<u>Analyte</u>	<u>% Recovery</u>	<u>Qualifier</u>
MHQ 709,	Antimony	18%	R
MHQ 715	Selenium	73%	J-S
	Thallium	5.2%	R

Please note that the antimony and thallium results are considered to be unusable and that the selenium results may possibly be biased low.

- C. All analysis (post digest) spike requirements were met for the above samples that required "N" flags. This is not required for GFAA analysis and applies to SOW 787 only.

Yes X No Not Applicable

Comments: No comment.

D. Laboratory control sample (LCS) frequency was met.

Yes X No

Comments: No comment.

E. LCS recoveries were within contract specified control limits (80-120%, except Ag and Sb for SOW 787).

Yes X No

Comments: No comment.

VII. Precision Statements

A. Matrix (pre-digest) duplicate frequency was met.

Yes X No

Comments: Sample MHQ 709 was used for matrix duplicate analysis.

B. Matrix (pre-digest) duplicate differences were within contract specified control limits (± 20 RPD or $\pm$ CRDL for results less than 5X the CRDL).

Yes No X

Comments:

The aluminum RPD was 21.6% and the iron RPD was 21.1% .As these were soil samples, the RPD's did not exceed the functional Guidelines Criteria, therefore the reviewer did not qualify the data.

VIII. ICP Quality Control

- A. Serial dilution frequency was met.

Yes X No

Comments: Sample MHQ 709 was used for serial dilution analysis.

- B. Differences for the serial dilution were within contract specified control limits (10% difference).

Yes No X

Comments:

1. The following is a table of samples, analytes, differences and qualifiers associated with a serial dilution exceeding the contract specified control limits:

<u>Sample</u>	<u>Analyte</u>	<u>% Difference</u>	<u>Qualifier</u>
MHQ709	Cu	42.4	J-E
	Zn	12.8	J-E
MHQ715	Cu	42.4	J-E
	Zn	12.8	J-E

- C. The CRDL check standard was run at the appropriate frequency for the analytes required.

Yes X No

Comments: No comments.

- D. The CRDL check standard exhibited recoveries which indicate that linearity problems are not likely at the lower end of the calibration curve.

Yes _____ No X

Comments: Silver exhibited potential linearity problems at the lower end of the calibration curve and the result for MHQ709 has been flagged as estimated "J-Q".

- E. The interference check sample (ICS) frequency was met.

Yes X No _____

Comments: No comment.

- F. ICS percent recovery results were reported for all required ICS analytes and were within contract specified control limits.

Yes X No _____

Comments: No comment.

- G. Significant positive or negative values were reported for ICP analytes not contained in the standard ICS.

Yes _____ No X

Comments: No comment.

- H. Duplicate injections were performed for all GFAA analyses (Method of Standard Addition (MSA) requires single injections only) and had RSDs of less than 20% where mean results were above the CRDL.

Yes X No _____

Comments: No comment.

- I. A. GFAA analysis (post-digest) spikes were performed on all required samples and at the concentration (2X CRDL) required.

Yes X No

Comments: No comment.

- B. Sample dilution and re-spiking was performed on all samples whose initial spike %R was less than 40%.

Yes X No

Comments: No comment.

- J. MSA was performed when required for GFAA analysis and followed the criteria specified in Exhibit E of the Statement of Work.

Yes X No NR

Comments: No comment.

IX. General Comments:

None.

Definition of Qualifiers
(Used by Data Reviewer)

(R) or (Rej) = Rejected ('R' used by laboratory indicates matrix spike recovery problems)

(U) = Undetected but estimated

(J) = Estimated

The following qualifiers give further detail of the type and amount of qualification a given data point has received.

-H = Qualified due to holding time violation

-E = Qualified due to interference problems (ICP serial dilution or poor analytical spike recovery by graphite furnace)

-I = Qualified due to exceeding ICP linear range

-* = Qualified due to duplicate control limits being exceeded

-S = Qualified due to matrix spike recoveries outside control limits

-C = Qualified due to instrument calibration problems

-L = Qualified due to LCS recoveries outside control limits

-B = Qualified due to blank contamination problems

-Q = Qualified due to reasons not stated above; see text of review

Example: The percent recovery of the Aluminum matrix spike was only 65%. Undetected values (e.g., Al 200u) will be flagged as follows:

Al 200u (U-S)

Meaning the reported undetected value of 200u is estimated (U) due to spike recovery problems (-S).

Reported positive Aluminum values (e.g., A. 250) will be flagged as follows:

AL 250 (J-S)

Meaning the reported positive result (250) is estimated (J) due to spike recovery problems (-S).

